EXHIBIT C

Exhibit C

Exemplary Accused Devices

Exemplary Router and Access Point Devices Provided by AT&T that support Wi-Fi 5 (and later):

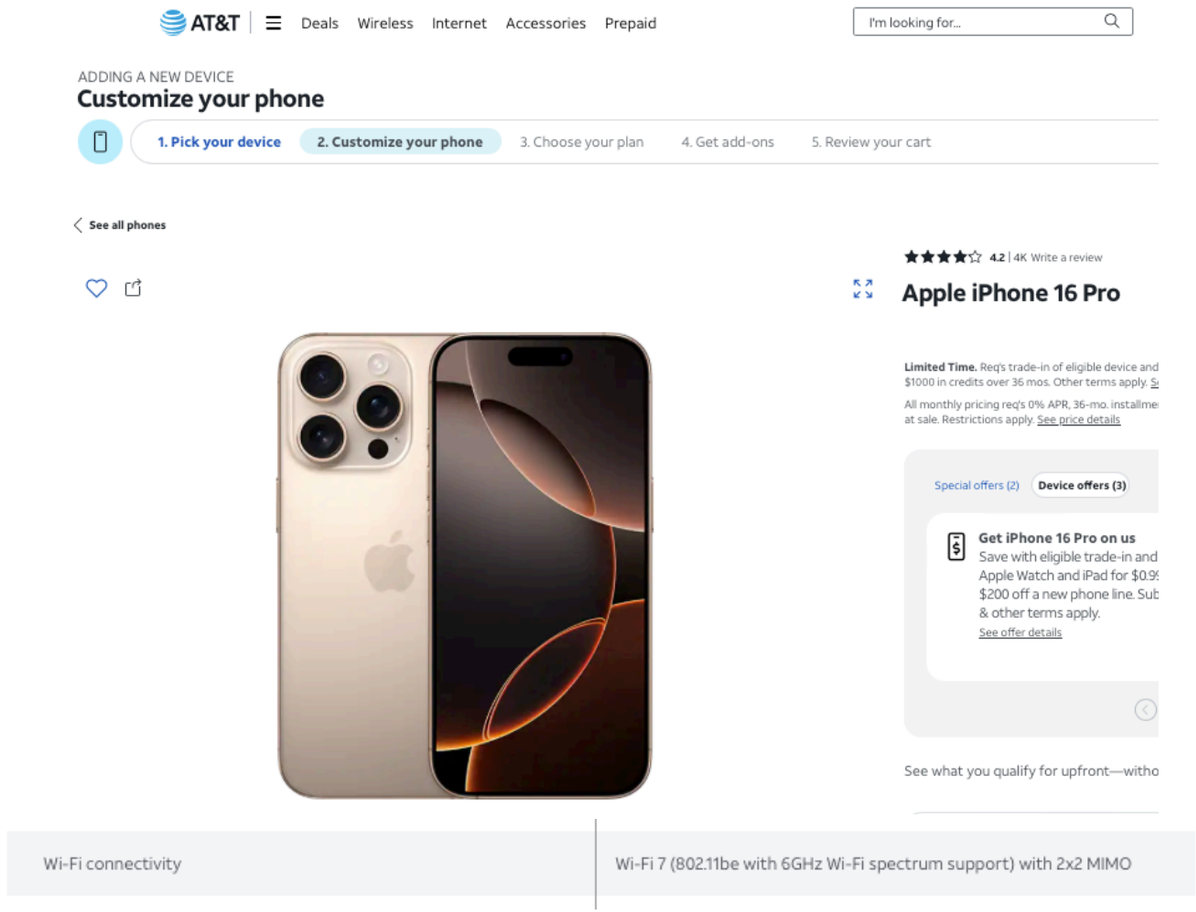
AT&T's Internet Air for Business 5G Gateway, AT&T's Turbo Hotspot 3 (ATTCKTHS02) - Wi-Fi 5, AT&T's Unite Express 2 (AC797S) - Wi-Fi 5 (802.11ac), AT&T's Unite Explore (AC815S) - Wi-Fi 5 (802.11ac), AT&T's Unite Express (AC779S) - Wi-Fi 5 (802.11ac), AT&T's Unite Pro (AC781S) - Wi-Fi 5 (802.11ac), AT&T's Unite (AC770S) - Wi-Fi 5 (802.11ac), AT&T's Wireless Internet (IFWA40) - Wi-Fi 5 (802.11ac), Franklin's A50 5G Mobile Hotspot (RG2102) - Wi-Fi 6 (802.11ax), Netgear's Nighthawk M7 Pro (MR7400) - Wi-Fi 6 (802.11ax), Netgear's Nighthawk M6 Pro (MR6500) - Wi-Fi 6 (802.11ax), Netgear's Nighthawk M6 (MR6110) - Wi-Fi 6 (802.11ax), Netgear's Nighthawk 5G Mobile Hotspot Pro (MR5100) - Wi-Fi 6 (802.11ax), Netgear's Nighthawk 5G Mobile Hotspot (MR5000) - Wi-Fi 6 (802.11ax), Netgear's Nighthawk LTE Mobile Hotspot Router (MR1100) - Wi-Fi 5 (802.11ac), Netgear's Nighthawk M7 Pro mobile hotspot - Wi-Fi 6 (802.11ax), Sierra Wireless' Unite (AC770S) - Wi-Fi 5 (802.11ac)

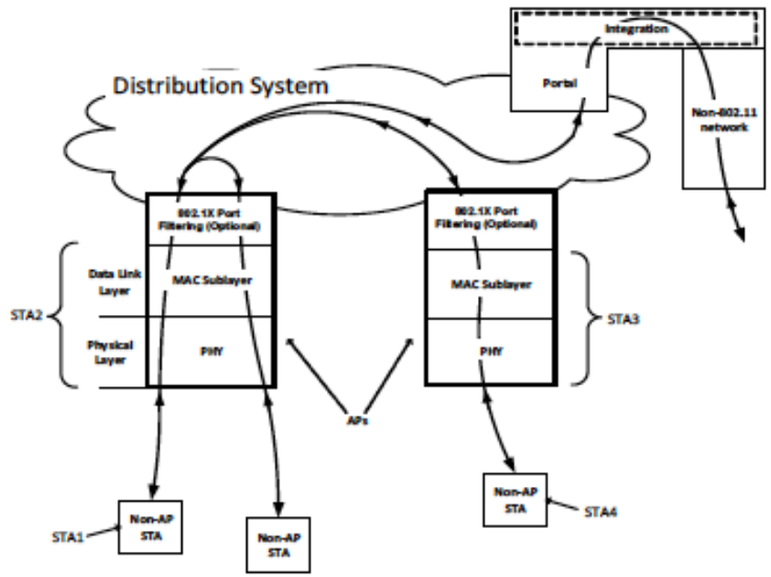
Exemplary Client Devices Provided by AT&T that support Wi-Fi 6 (and later):

Google Pixel 8a, Google Pixel 8, Google Pixel 7a, Google Pixel 9 Pro XL, Google Pixel 9 Pro, Google Pixel 9, Motorola moto g stylus 5G (2024), Motorola Razr (2023), Motorola Razr+ 2024, Apple's iPhone 16 Pro, Apple's iPhone 16 Pro Max, Apple's iPhone 16 Plus, Apple's iPhone 16, Apple's iPhone 15, Apple's iPhone 15 Pro Max, Apple's iPhone 15 Pro, Apple's iPhone SE 3rd Gen (2022), Apple's iPhone 14, Apple's iPhone 15 Plus, Apple's iPad Pro 13-inch (2024), Apple's iPad 10th Generation (2022), Apple's iPad Air 13-inch (2024), Apple - iPad Pro 11-inch (2024), Apple's iPad Air 11-inch (2024), Apple's iPad mini (2024), Apple's iPad mini (2021), Apple's iPhone 16 Pro, Apple's iPhone 16 Pro Max

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
[1Pre] A data communication system comprising: [1A] a plurality of terminals connected to a communication channel, each terminal transmitting signals onto said communication channel, and receiving signals transmitted on said communication channel by other terminals, said receiving comprising separating and substantially decoding the signals simultaneously transmitted by multiple other terminals, each terminal comprising:	AT&T provides high speed internet service, including Wi-Fi 6 (and later) routers and access points, which comply with 802.11ax and 802.11be (Wi-Fi 7), which is backward compatible with 802.11ax and supports all essential carrier sensing, Orthogonal Frequency Division Multiple Access (OFDMA), and Multiple Input, Multiple Output (MIMO) mechanisms. AT&T also provides client devices, terminals, or stations (STAs) that are Wi-Fi 6 (and later) compliant and operate on AT&T networks including APs that are Wi-Fi 6 complaint. The 802.11ax standard defines a data communication system that supports multi-user transmission. An Access Point (AP) can transmit data to multiple terminals or STAs simultaneously, and multiple STAs can also transmit data to the AP concurrently. The STAs are not limited to smartphones supporting Wi-Fi 6. The STAs can also work as access points in case of Hotspots. Currently, from AT&T **NEXT GEN WI-FI 6 AND OUR NEW GATEWAY** A new and improved Wi-Fi is here, setting the standard for how we connect

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	Wi-Fi is everywhere, and we use it for nearly everything these days. From cars to coffee makers, our reliance on wireless internet has grown exponentially in recent years. We need the strongest, and the smartest, Wi-Fi we can get, and that is especially true in more populated areas. More people mean more need, and more need means more data being exchanged. So, what is next in the evolution of the very thing that keeps us moving? Introducing Wi-Fi 6, the next-generation in wireless internet. While it offers more speed, it can also provide better performance in densely populated areas, from concerts and sports arenas to your multi-family homes and buildings. Wi-Fi 6 has launched, but its true power is still yet to be felt. **Source:** Robbie Imes, *Next Gen Wi-Fi 6 and Our New Gateway: A New and Improved Wi-Fi Is Here, Setting the Standard for How We Connect,* AT&T, https://more.att.com/currently/this-month/fiber/next-gen-wi-fi-6-and-our-new-gateway

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	 **Source:** Apple iPhone 16 Pro, AT&T, https://www.att.com/buy/phones/apple-iphone-16-pro.html

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	 **Figure 4-18—IEEE 802.11 Infrastructure model** **Source:** 802.11-2020 at p. 262 The Wi-Fi 6 (and later) client devices sold by AT&T are each a terminal connected to a communication channel. Each of the devices is configured to transmit signals onto the communication channel, and to receive signals transmitted on said communication channel by other terminals. For example, a terminal can directly receive signals from another terminal on the network when that terminal is acting as an AP, or can indirectly receive signals

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	transmitted by other non-AP terminals on the network via an AP. In this manner, the receivers can separate and substantially decode signals simultaneously transmitted by multiple other terminals and APs.

27.3.1.2 OFDMA

OFDMA is an OFDM-based multiple access scheme where different subsets of subcarriers are allocated to different users, and this scheme allows simultaneous data transmission to or from one or more users. In OFDMA, users are allocated different subsets of subcarriers that can change from one PPDU to the next. The difference between OFDM and OFDMA is illustrated in Figure 27-4. Similar to OFDM, OFDMA employs multiple subcarriers, but the subcarriers are divided into several groups where each group is referred to as an RU. With OFDMA, different transmit powers may be applied to different RUs.

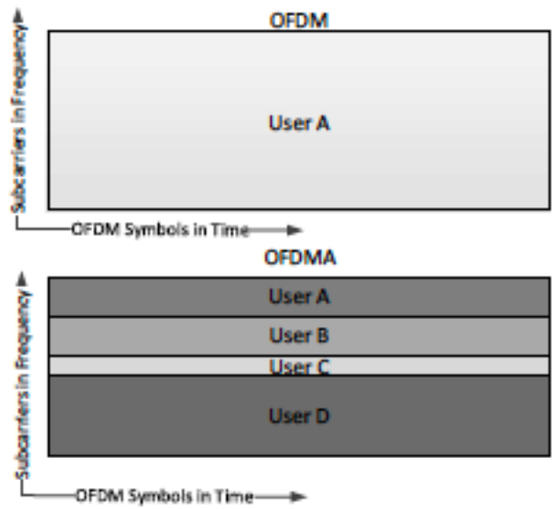


Figure 27-4—Illustration of OFDM and OFDMA concepts

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	Source: 802.11ax-2021 at p. 497 **27.3.3.2 UL MU-MIMO** **27.3.3.2.1 Introduction** UL MU-MIMO is a technique to allow multiple STAs to transmit simultaneously over the same frequency resource to the receiver. The concept is very similar to SU-MIMO where multiple space-time streams are transmitted simultaneously over the same frequency resource utilizing spatial multiplexing through multiple antennas at the transmitter and receiver. The key difference from SU-MIMO is that in UL MU-MIMO, the transmitted streams originate from multiple STAs. **Source:** IEEE 802.11 ax, Page 509 of 766. MU-RTS multi-user request to send **Source:** IEEE 802.11 ax, Page 46 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

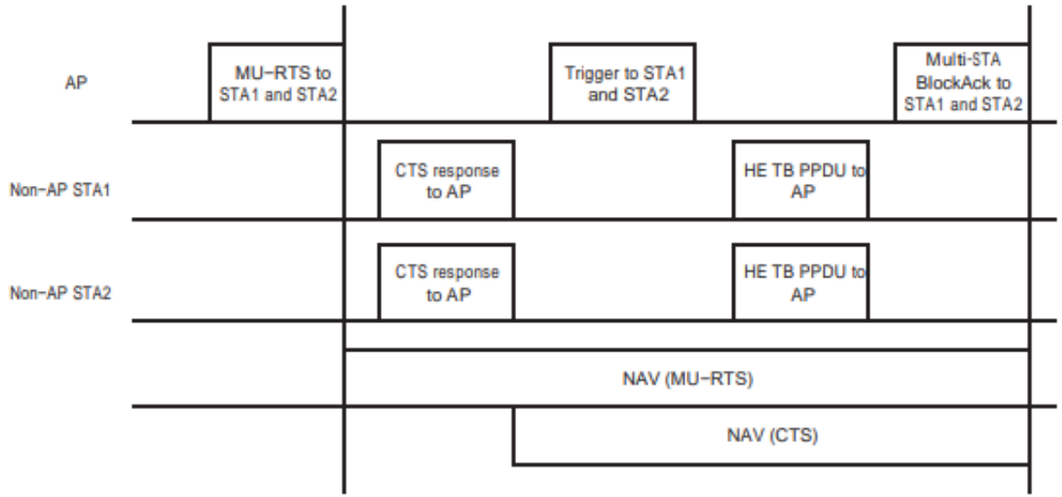
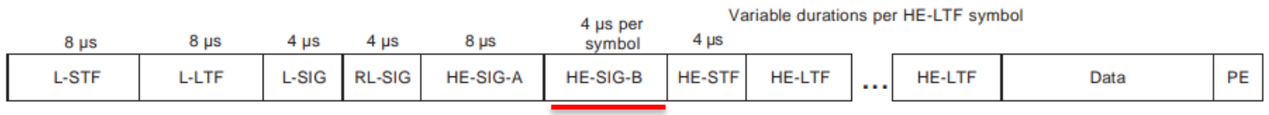


Figure 26-2—Example of MU-RTSICTSITriggerIHE TB PPDUIMulti-STA BlockAck and NAV setting

Source: IEEE 802.11 ax, Page 317 of 766.

According to 802.11ax, there is a signal known as MU-RTS (Multi-user Request to send). This signal helps in coordinating and managing the wireless medium for multiple devices (i.e., STAs). Once AP generates this signal, the terminals which are on the same frequency resource send a CTS (clear to send) to the AP. Once the trigger frame is generated by AP, terminals start sending PPDUs (Physical Protocol Data Units) simultaneously over the same communication channel based on certain conditions. The high efficiency (HE) STAs have the capability to transmit and receive PPDUs (data units/information) from other devices (AP and terminals acting as AP). The HE MU PPDU format includes HE-SIG A and HE-SIG B signals which have the decoding details.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	27.3.4 HE PPDU formats Four HE PPDU formats are defined: HE SU PPDU, HE MU PPDU, HE ER SU PPDU, and HE TB PPDU. The HE sounding NDP is a variant of the HE SU PPDU and defined in 27.3.17. The HE TB feedback NDP is a variant of the HE TB PPDU and defined in 27.3.18. …….  **Figure 27-9—HE MU PPDU format** **Source:** IEEE 802.11 ax, Page 510 of 766. The union of the User Specific fields in the HE-SIG-B content channels contains information for all users in the PPDU on how to decode their payload. As shown in Figure 27-26, the User Specific field is organized into User Block fields that in turn contain User fields. See 27.3.11.8.4 for a description of the contents of the User Specific field. **Source:** IEEE 802.11 ax, Page 560 of 766.
[1B] a monitoring subsystem determining whether signal energy	The Wi-Fi 6 (and later) client devices sold by AT&T each include a monitoring subsystem (e.g., hardware and associated software implementing portions of the Wi-Fi 6 physical layer that monitor signal energy on a communication channel) for determining whether the signal energy on the communication channel exceeds a

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
on said communication channel exceeds a predetermined amount;	predetermined amount. The client devices' monitoring system implements the Uplink (UL) Multiuser (MU) Carrier sense mechanism, which performs an energy detection (ED) based CCA (Clear Channel Assessment). According to 802.11ax, Uplink Multiuser Carrier sense mechanism defines an energy detection (ED)-based CCA (Clear Channel Assessment). The monitoring subsystem determines whether signal energy on a communication channel exceeds a predetermined amount, for example, by determining whether one or more 20 MHz regions to be used is available. *See, e.g.*, **26.5.2.5 UL MU CS mechanism** The ED-based CCA and virtual CS functions are used to determine the state of the medium if CS is required before responding to a received Trigger frame. ED-based CCA for the UL MU CS mechanism is defined in 27.3.20.6.4, and virtual CS is defined in 10.3.2.1. **26.5.2 UL MU operation** **26.5.2.1 General** UL MU operation allows an AP to solicit simultaneous immediate response frames from one or more non-AP HE STAs. A non-AP HE STA shall follow the rules in this subclause for the transmission of response frames in an HE TB PPDU, unless the Trigger frame is an MU-RTS Trigger frame, in which case the response is a CTS frame sent in a non-HT PPDU (see 26.2.6).

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

If the CS Required subfield in a Trigger frame is 1, then the non-AP STA shall consider the status of the CCA [using energy detect defined in 27.3.20.6.2 and the virtual carrier sense (NAV)] during the SIFS between the Trigger frame and the PPDU sent in response to the Trigger frame. In this case, the non-AP STA shall sense the medium using energy detect after receiving the PPDU that contains the Trigger frame (i.e., during the SIFS), and it shall perform the energy detect at least in the subchannel that contains the non-AP STA's UL allocation, where the sensed subchannel consists of one or more 20 MHz channels. The non-AP STA may transmit the solicited PPDU if the 20 MHz channels containing the RUs allocated in the Trigger frame are considered idle. If the non-AP STA detects that the 20 MHz channels containing the allocated RUs are not all idle, then the non-AP STA shall not transmit.

NOTE 5—The solicited PPDU is a non-HT or non-HT duplicate PPDU if the Trigger frame is an MU-RTS Trigger frame (see 26.2.6); otherwise, the solicited PPDU is an HE TB PPDU (see 26.5.2.3).

The CS Required subfield in the MU-RTS Trigger frame shall be set to 1.

An AP that transmits a Basic, BSRP, MU-BAR, BQRP, or GCR MU-BAR Trigger frame shall set the CS Required subfield to 1, unless one of the following conditions is met:

— The RA of the Trigger frame is an individually addressed non-AP STA's MAC address, a QoS Data frame with HETP Ack ack policy and/or a Management frame that solicits an acknowledgment is aggregated with the Trigger frame in an A-MPDU, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418.

— The Trigger frame is either an MU-BAR or a GCR MU-BAR Trigger frame, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418.

— The UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 76.

Source: IEEE 802.11 ax, Page 341, and 357 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

27.3.20.6 CCA sensitivity

27.3.20.6.1 General

The thresholds in 27.3.20.6 are compared with the signal level at each receiving antenna.

27.3.20.6.2 CCA sensitivity for operating classes requiring CCA-ED

For the operating classes requiring CCA-Energy Detect (CCA-ED), the PHY shall indicate a medium busy condition if CCA-ED detects a channel busy condition. For improved spectrum sharing, CCA-ED is required in some bands. The behavior class indicating CCA-ED is given in Table D-2. The operating classes requiring the corresponding CCA-ED behavior class are given in E.1. The PHY of a STA that is operating within an operating class that requires CCA-ED shall operate with CCA-ED.

CCA-ED for a STA that is attempting a non-preamble puncturing transmission shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for the primary 20 MHz channel, dot11OFDMEDThreshold for the secondary 20 MHz channel (if present), dot11OFDMEDThreshold + 3 dB for the secondary 40 MHz channel (if present), and dot11OFDMEDThreshold + 6 dB for the secondary 80 MHz channel (if present). The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5.

CCA-ED for a STA that is attempting a preamble puncturing transmission shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for the primary 20 MHz channel and dot11OFDMEDThreshold for each nonprimary 20 MHz subchannel. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5.

For the HE TB PPDU transmission, for each of 20 MHz sub-channels that require CCA, CCA-ED shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5.

For transmissions that carry a frame that includes a BQR Control subfield (see 9.2.4.6a), CCA-ED shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for primary 20 MHz channel and dot11OFDMEDThreshold for each nonprimary 20 MHz channel (if present). The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5.

NOTE—The requirement to detect a channel busy condition as stated in 27.3.20.6.3 and 27.3.20.6.4 is a mandatory energy detect requirement on all Clause 27 receivers. Support for CCA-ED is an additional requirement that relates specifically to the sensitivities described in D.2.5.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

Source: IEEE 802.11 ax, Page 644 and 645 of 766.

27. High-efficiency (HE) PHY specification

27.1 Introduction

27.1.1 Introduction to the HE PHY

Clause 27 specifies the PHY entity for a high-efficiency (HE) orthogonal frequency division multiplexing (OFDM) system. In addition to the requirements in Clause 27, an HE STA shall be capable of transmitting and receiving PPDUs that are compliant with the mandatory requirements of the following PHY specifications:

- Clause 19 and Clause 21 if the HE STA supports an operating channel width greater than or equal to 80 MHz and is operating in the 5 GHz band.
- Clause 19 and Clause 21 transmission and reception on 20 MHz channel width (see 26.17.1) if the HE STA is a 20 MHz-only non-AP HE STA and is operating in the 5 GHz band.
- Clause 19 if the HE STA is operating in the 2.4 GHz band.
- Clause 17 if the HE STA is operating in the 6 GHz band.

For 2.4 GHz band operation, the HE PHY is based on HT PHY defined in Clause 19, which in turn is based on the OFDM PHY defined in Clause 17.

For 5 GHz band operation, the HE PHY is based on the VHT PHY defined in Clause 21, which in turn is based on the HT PHY defined in Clause 19, which in turn is further based on the OFDM PHY defined in Clause 17.

For 6 GHz band operation, the HE PHY is based on the OFDM PHY defined in Clause 17.

Source: IEEE 802.11 ax, Page 465 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	According to 802.11ax, all HE STAs (terminals supporting Wi-Fi 6) must comply with Clause 27. Clause 27 requires that all HE STAs implement the Multiuser Carrier Sense mechanism, which defines an energy detection (ED)-based Clear Channel Assessment (CCA) technique. This clause refers to the HE PHY specification, which is followed by all Wi-Fi 6 compliant devices, including smartphones like the iPhone 16 that support Wi-Fi 6. According to 802.11ax, an AP sends a trigger frame to the STAs, and if the CS required subfield in the trigger frame is set to 1, the STA must check the status of the CCA. The STA senses the CCA Energy Detect (CCA-ED) and compares it to the CCA-ED threshold. **27.3.20.6.3 CCA sensitivity for the primary 20 MHz channel** An HE STA with a *W* MHz operating channel width shall detect, with > 90% probability, the start of a PPDU that occupies at least the primary 20 MHz channel in an otherwise idle *W* MHz channel width and issue a PHY-CCA.indication with the STATUS parameter set to BUSY within a period of aCCATime (see 21.4.4) if one of the following conditions is met: — The start of a non-HT PPDU as defined in 17.3.10.6 if operating in the 5 GHz or 6 GHz band and 18.4.6 if operating in the 2.4 GHz band. — The start of an HT PPDU as defined in 19.3.19.5. — The start of a non-HT duplicate, VHT or HE PPDU for which the power measured within the primary 20 MHz channel is at or above –82 dBm. The channel-list parameter is present and set to {primary} if the operating channel width is greater than 20 MHz. The CCA signal shall be held busy (not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE) for the duration of the PPDU, unless it receives a CCARESET.request primitive before the end of the PPDU, for instance, during spatial reuse operation as described in 26.10. The receiver shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY for any signal that exceeds a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (–82 + 20 = –62 dBm) in the primary 20 MHz channel within a period of aCCATime after the signal arrives at the receiver's antenna(s). If the operating channel width is greater than 20 MHz, then the channel-list

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

parameter is present and shall be set to {primary}. Following the indication and while the threshold continues to be exceeded, the receiver shall not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE or with a change in the channel-list parameter.

Source: IEEE 802.11 ax, Page 645 and 646 of 766.

27.3.20.6.5 Per 20 MHz CCA sensitivity

If the operating channel width is greater than 20 MHz and the PHY issues a PHY-CCA.indication primitive, the PHY shall set the per20bitmap to indicate the busy/idle status of each 20 MHz subchannel. A 20 MHz subchannel is busy if at least one of the following conditions is present in an otherwise idle 40 MHz, 80 MHz, 80+80 MHz, or 160 MHz channel:

— A signal is present on the 20 MHz subchannel at or above a threshold of –62 dBm at the receiver's antenna(s). The PHY shall indicate that the 20 MHz subchannel is busy a period aCCATime after the signal starts and shall continue to indicate the 20 MHz subchannel is busy while the threshold continues to be exceeded.

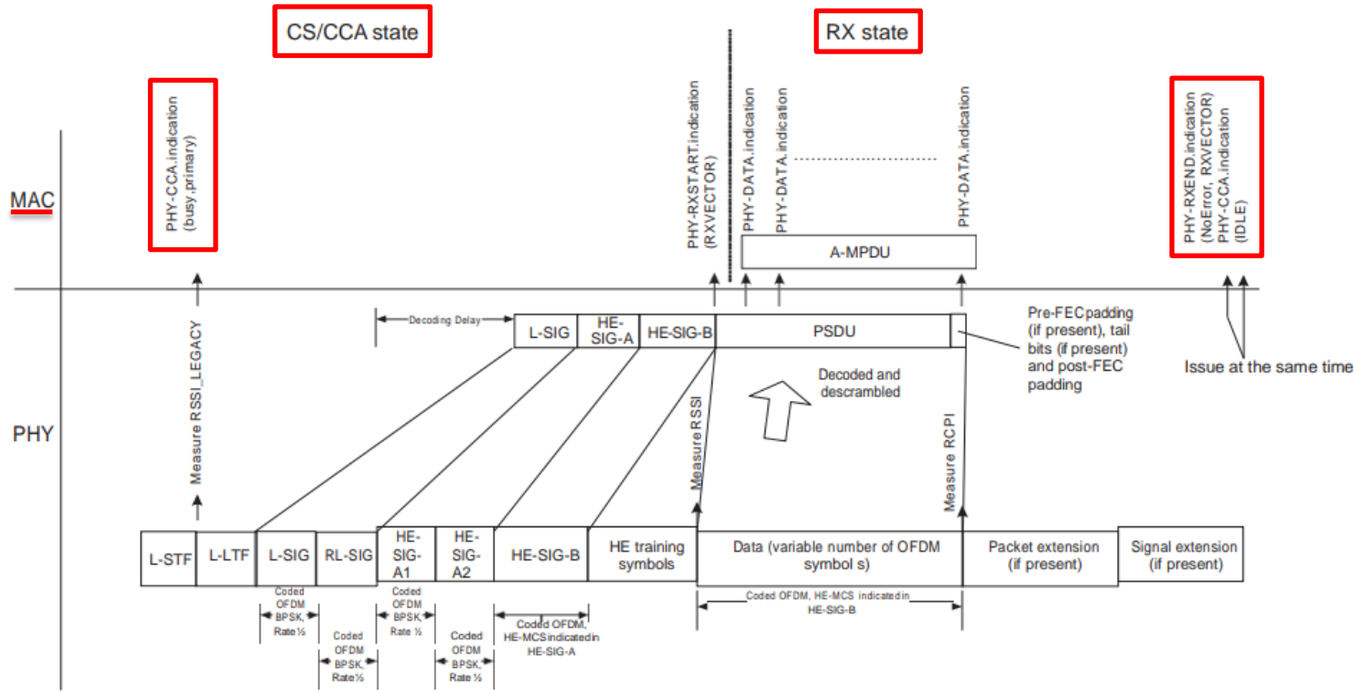
— The 20 MHz subchannel is in a channel on which an 80 MHz non-HT duplicate, VHT or HE PPDU at or above max(–69 dBm, $OBSS\_PD_{level}$ + 6 dB) at the receiver's antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4).

— The 20 MHz subchannel is in a channel on which a 40 MHz non-HT duplicate, HT_MF, HT_GF, VHT or HE PPDU at or above max(–72 dBm, $OBSS\_PD_{level}$ + 3 dB) at the receiver's antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4).

— A 20 MHz non-HT, HT_MF, HT_GF, VHT, or HE PPDU at or above max(–72 dBm, $OBSS\_PD_{level}$) at the receiver's antenna(s) is present on the 20 MHz subchannel. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4).

Source: IEEE 802.11ax-0221, Page 647.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
[1C] a component generating and processing network data packets; and	The Wi-Fi 6 (and later) client devices sold by AT&T each include a component (e.g., a processor and associated software implementing a portion of the Wi-Fi 6 MAC-layer functionality on the devices) for generating and processing network data packets. According to 802.11ax, the MAC (Medium Access Control) is responsible for carrier sensing and CCA. Based on the PHY-CCA signal indication, the MAC generates and processes network data packets accordingly. **5. MAC service definition** **5.1 Overview of MAC services** **5.1.1 Data service** **5.1.1.1 General** This service provides peer LLC sublayer entities or IEEE 802.1Q bridge ports with the ability to exchange MSDUs. To support this service, the local MAC uses the underlying PHY-level services to transport an MSDU to a peer MAC entity, where it is delivered to the peer LLC sublayer or bridge port. Such asynchronous MSDU transport is performed on a connectionless basis. By default, MSDU transport is on a best-effort basis. However, the QoS facility uses a traffic identifier (TID) to specify differentiated services on a per-MSDU basis. The QoS facility also permits more synchronous behavior to be supported on a connection-oriented basis using TSPECs. There are no guarantees that the submitted MSDU will be delivered successfully. Group addressed transport is part of the data service provided by the MAC. Due to the characteristics of the WM, group addressed MSDUs might experience a lower QoS, compared to that of individually addressed MSDUs. All STAs support the data service, but only QoS STAs in a QoS BSS differentiate their MSDU delivery according to the designated traffic category or traffic stream (TS) of individual MSDUs. QoS STAs that support the QMF service differentiate their MMPDU delivery according to the MMPDU's access category. The access category of each MMPDU is designated by the transmitter's current QMF policy. **Source:** 802.11-2020 at p. 294.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	 **Figure 27-61—PHY receive procedure for an HE MU PPDU** **Source:** IEEE 802.11 ax, Page 653 of 766.
[1D] a control subsystem that accepts said network data packets from said component and	The Wi-Fi 6 (and later) client devices sold by AT&T each include a control subsystem (e.g., a processor and associated software for implementing portions of the Wi-Fi 6 MAC and/or PHY layer functionality on the devices that determines a manner in which to transmit packets) that accepts said network data packets from said component

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
determines a manner in which to transmit said network data packets over said communication channel;	and determines a manner in which to transmit said network data packets over said communication channel. According to 802.11ax, based on the generated network data packets, the controlling STA operates as follows: if the CCA indication is BUSY, the STA will back off and avoid transmitting the packets; if the CCA indication is IDLE, the STA will proceed with the transmission of the packets.

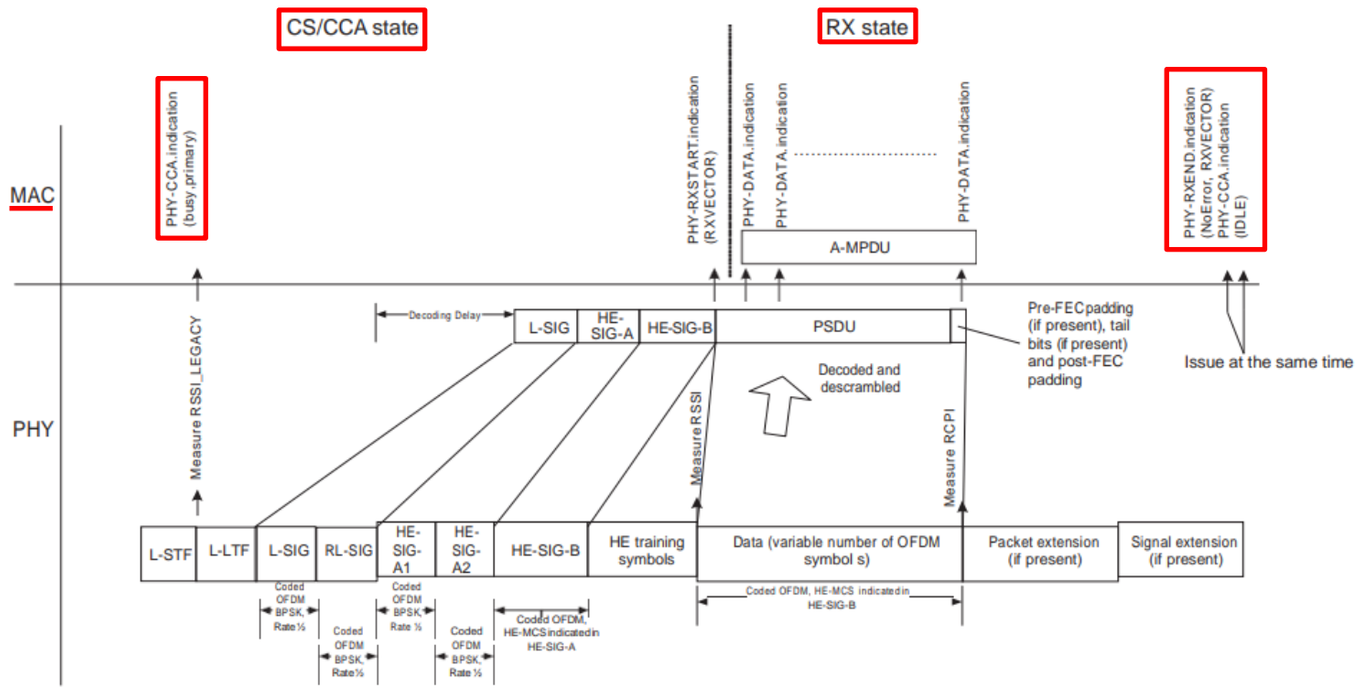


Figure 27-61—PHY receive procedure for an HE MU PPDU

Source: IEEE 802.11 ax, Page 653 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

27.3.20.6.3 CCA sensitivity for the primary 20 MHz channel

An HE STA with a *W* MHz operating channel width shall detect, with > 90% probability, the start of a PPDU that occupies at least the primary 20 MHz channel in an otherwise idle *W* MHz channel width and issue a PHY-CCA.indication with the STATUS parameter set to BUSY within a period of aCCATime (see 21.4.4) if one of the following conditions is met:

— The start of a non-HT PPDU as defined in 17.3.10.6 if operating in the 5 GHz or 6 GHz band and 18.4.6 if operating in the 2.4 GHz band.

— The start of an HT PPDU as defined in 19.3.19.5.

— The start of a non-HT duplicate, VHT or HE PPDU for which the power measured within the primary 20 MHz channel is at or above –82 dBm.

The channel-list parameter is present and set to {primary} if the operating channel width is greater than 20 MHz. The CCA signal shall be held busy (not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE) for the duration of the PPDU, unless it receives a CCARESET.request primitive before the end of the PPDU, for instance, during spatial reuse operation as described in 26.10.

The receiver shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY for any signal that exceeds a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (–82 + 20 = –62 dBm) in the primary 20 MHz channel within a period of aCCATime after the signal arrives at the receiver's antenna(s). If the operating channel width is greater than 20 MHz, then the channel-list parameter is present and shall be set to {primary}. Following the indication and while the threshold continues to be exceeded, the receiver shall not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE or with a change in the channel-list parameter.

Source: IEEE 802.11 ax, Page 645 and 646 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	27.3.20.6.5 Per 20 MHz CCA sensitivity If the operating channel width is greater than 20 MHz and the PHY issues a PHY-CCA.indication primitive, the PHY shall set the per20bitmap to indicate the busy/idle status of each 20 MHz subchannel. A 20 MHz subchannel is busy if at least one of the following conditions is present in an otherwise idle 40 MHz, 80 MHz, 80+80 MHz, or 160 MHz channel: — A signal is present on the 20 MHz subchannel at or above a threshold of –62 dBm at the receiver's antenna(s). The PHY shall indicate that the 20 MHz subchannel is busy a period aCCATime after the signal starts and shall continue to indicate the 20 MHz subchannel is busy while the threshold continues to be exceeded. — The 20 MHz subchannel is in a channel on which an 80 MHz non-HT duplicate, VHT or HE PPDU at or above max(–69 dBm, $OBSS\_PD_{level}$ + 6 dB) at the receiver's antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4). — The 20 MHz subchannel is in a channel on which a 40 MHz non-HT duplicate, HT_MF, HT_GF, VHT or HE PPDU at or above max(–72 dBm, $OBSS\_PD_{level}$ + 3 dB) at the receiver's antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4). — A 20 MHz non-HT, HT_MF, HT_GF, VHT, or HE PPDU at or above max(–72 dBm, $OBSS\_PD_{level}$) at the receiver's antenna(s) is present on the 20 MHz subchannel. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4). **Source:** IEEE 802.11ax-0221, Page 647.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

If the CS Required subfield in a Trigger frame is 1, then the non-AP STA shall consider the status of the CCA [using energy detect defined in 27.3.20.6.2 and the virtual carrier sense (NAV)] during the SIFS between the Trigger frame and the PPDU sent in response to the Trigger frame. In this case, the non-AP STA shall sense the medium using energy detect after receiving the PPDU that contains the Trigger frame (i.e., during the SIFS), and it shall perform the energy detect at least in the subchannel that contains the non-AP STA's UL allocation, where the sensed subchannel consists of one or more 20 MHz channels. The non-AP STA may transmit the solicited PPDU if the 20 MHz channels containing the RUs allocated in the Trigger frame are considered idle. If the non-AP STA detects that the 20 MHz channels containing the allocated RUs are not all idle, then the non-AP STA shall not transmit.

NOTE 5—The solicited PPDU is a non-HT or non-HT duplicate PPDU if the Trigger frame is an MU-RTS Trigger frame (see 26.2.6); otherwise, the solicited PPDU is an HE TB PPDU (see 26.5.2.3).

The CS Required subfield in the MU-RTS Trigger frame shall be set to 1.

An AP that transmits a Basic, BSRP, MU-BAR, BQRP, or GCR MU-BAR Trigger frame shall set the CS Required subfield to 1, unless one of the following conditions is met:

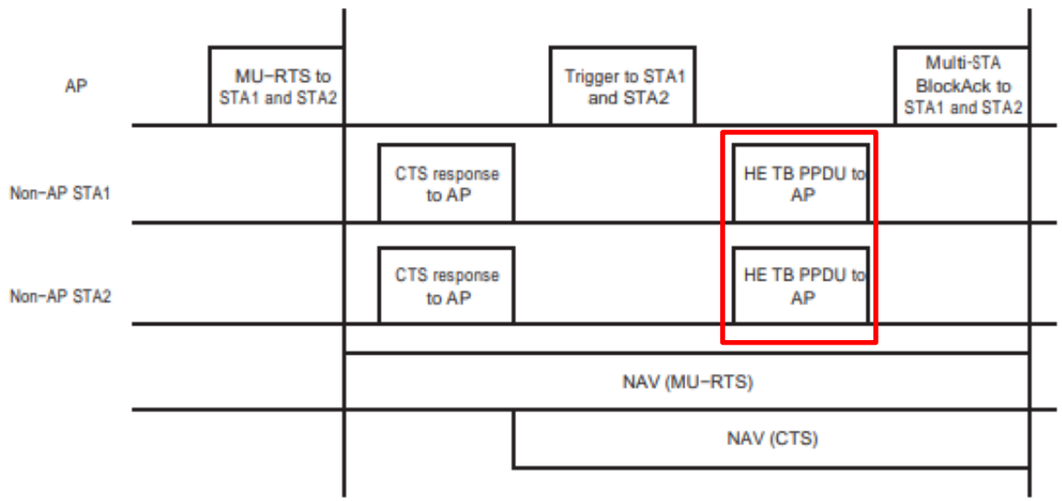
— The RA of the Trigger frame is an individually addressed non-AP STA's MAC address, a QoS Data frame with HETP Ack ack policy and/or a Management frame that solicits an acknowledgment is aggregated with the Trigger frame in an A-MPDU, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418.

— The Trigger frame is either an MU-BAR or a GCR MU-BAR Trigger frame, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418.

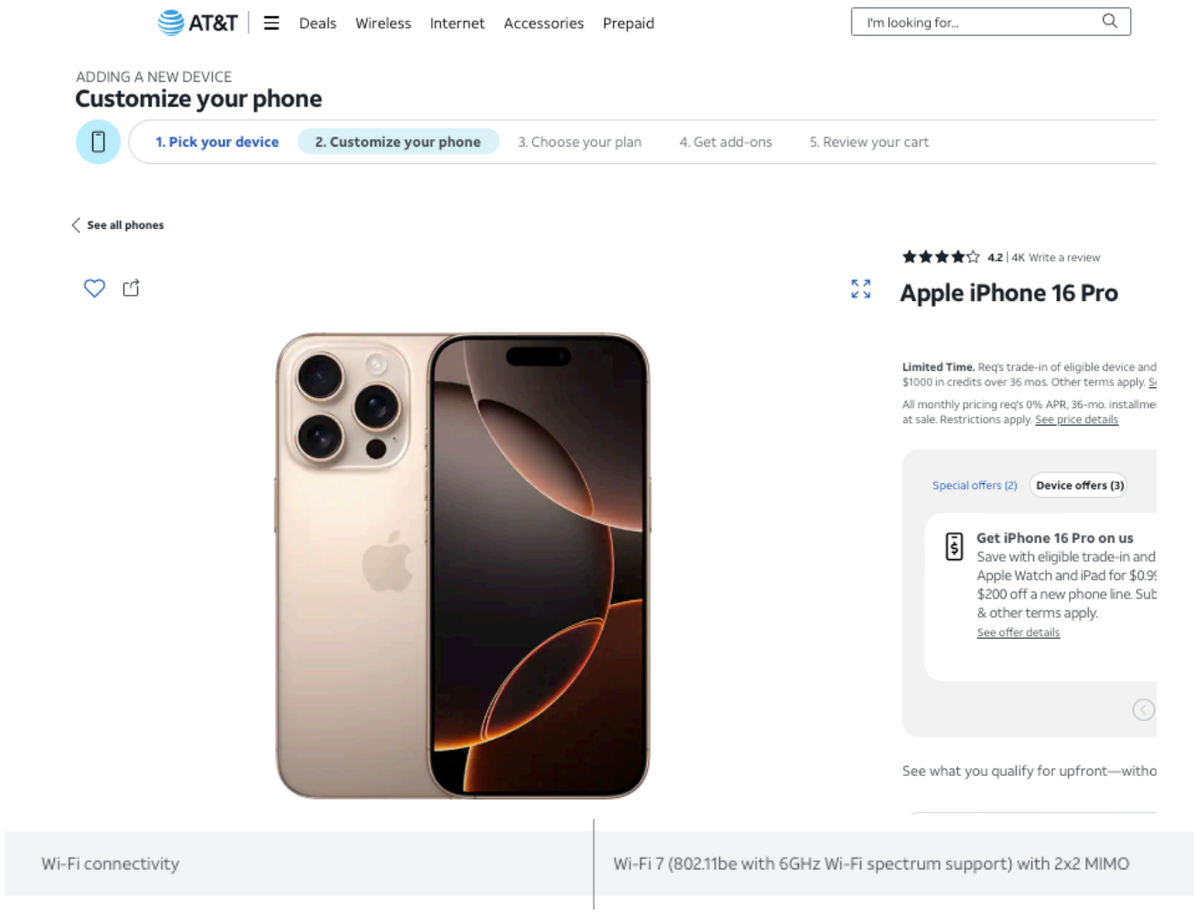
— The UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 76.

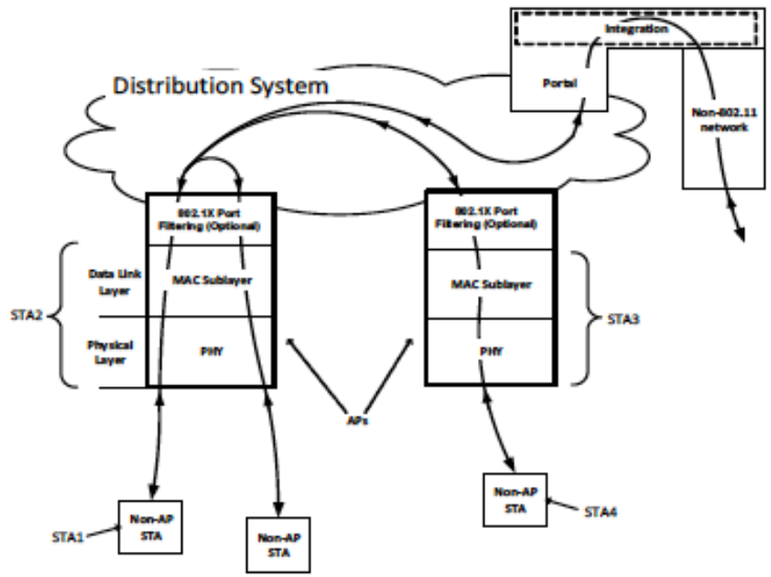
Source: IEEE 802.11 ax, Page 357 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	According to 802.11ax, a non-AP STA is permitted to send an HE TB PPDU after a SIFS period following the reception of a PPDU, if the following conditions are met: 1) The received PPDU includes a Trigger frame, 2) Either the CS Required subfield in the Trigger frame is set to 1 and the UL MU CS condition shows the medium is idle, or the CS Required subfield is set to 0. **26.5.2.3 Non-AP STA behavior for UL MU operation** A non-AP STA shall not transmit an HE TB PPDU if all of the conditions in 26.5.2.3.2 are satisfied. Otherwise, a non-AP STA shall transmit an HE TB PPDU a SIFS after a received PPDU if all of the following conditions are met: — The received PPDU contains either a Trigger frame (that is not an MU-RTS variant) with a User Info field addressed to the non-AP STA or a frame addressed to the non-AP STA that contains an TRS Control subfield. A User Info field in the Trigger frame is addressed to a non-AP STA if one of the following conditions are met: — The CS Required subfield in the Trigger frame is 1, and the UL MU CS condition described in 26.5.2.5 indicates the medium is idle; or the CS Required subfield in a Trigger frame is 0; or the response was solicited by a frame containing a TRS Control subfield. **Source:** IEEE 802.11 ax, Page 349 of 766.
[1E] said control subsystem enabling a plurality of said network data packets to be successfully transmitted simultaneously on said communication channel.	The Wi-Fi 6 (and later) software on the devices that implements the CCA, OFDMA, and MIMO mechanisms of Wi-Fi 6 (and later) enables a plurality of said network data packets to be successfully transmitted simultaneously on said communication channel. According to 802.11ax, a non-AP STA is permitted to send an HE TB PPDU after a SIFS period following the reception of a PPDU, if the following conditions are met: 1) The received PPDU includes a Trigger frame, 2) Either the CS Required subfield in the Trigger frame is set to 1 and the UL MU CS

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	condition shows the medium is idle, or the CS Required subfield is set to 0. Also, as per the evidence below, the data packets from different STAs to AP are being transmitted simultaneously. *See, e.g.*,  **Figure 26-2—Example of MU-RTSICTSITriggerIHE TB PPDUIMulti-STA BlockAck and NAV setting** **Source:** IEEE 802.11 ax, Page 317 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	26.5.2.3 Non-AP STA behavior for UL MU operation A non-AP STA shall not transmit an HE TB PPDU if all of the conditions in 26.5.2.3.2 are satisfied. Otherwise, a non-AP STA shall transmit an HE TB PPDU a SIFS after a received PPDU if all of the following conditions are met: — The received PPDU contains either a Trigger frame (that is not an MU-RTS variant) with a User Info field addressed to the non-AP STA or a frame addressed to the non-AP STA that contains an TRS Control subfield. A User Info field in the Trigger frame is addressed to a non-AP STA if one of the following conditions are met: — The CS Required subfield in the Trigger frame is 1, and the UL MU CS condition described in 26.5.2.5 indicates the medium is idle; or the CS Required subfield in a Trigger frame is 0; or the response was solicited by a frame containing a TRS Control subfield. **Source:** IEEE 802.11 ax, Page 349 of 766.
[26Pre] A terminal system comprising:	AT&T provides high speed internet service, including Wi-Fi 6 (and later) routers and access points, which comply with 802.11ax and 802.11be (Wi-Fi 7), which is backward compatible with 802.11ax and supports all essential carrier sensing, OFDMA, and MIMO mechanisms. AT&T also provides client devices, terminals, or stations (STAs) that are Wi-Fi 6 (and later) compliant and operate on AT&T networks including APs that are Wi-Fi 6 complaint. The 802.11ax standard defines a data communication system that supports multi-user transmission. An Access Point (AP) can transmit data to multiple terminals or STAs simultaneously, and multiple STAs can also transmit data to the AP concurrently. The STAs are not limited to smartphones supporting Wi-Fi 6. The STAs can also work as access points in case of Hotspots. The Wi-Fi 6 (and later) client devices sold by AT&T function as terminals connected to a communication channel. For example, the Apple iPhone 16 Pro (sold by AT&T), which supports Wi-Fi 7 (IEEE 802.11be), will also support Wi-Fi 6 (IEEE 802.11ax) due to backward compatibility.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	 **Source**: https://www.att.com/buy/phones/apple-iphone-16-pro.html

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	 **Figure 4-18—IEEE 802.11 Infrastructure model** **Source:** 802.11-2020 at p. 262
[26A] a monitoring subsystem determining whether signal energy on a communication channel exceeds a predetermined amount;	The Wi-Fi 6 (and later) client devices sold by AT&T each include a monitoring subsystem (e.g., hardware and related software implementing portions of the Wi-Fi 6 physical layer that monitor signal energy on a communication channel) for determining whether the signal energy on the communication channel exceeds a predetermined amount. The client devices' monitoring system implements the Uplink Multiuser Carrier sense mechanism, which performs an energy detection (ED)-based CCA (Clear Channel Assessment). According to 802.11ax, Uplink

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	Multiuser Carrier sense mechanism defines an energy detection (ED) based CCA (Clear Channel Assessment). The monitoring subsystem determines whether signal energy on a communication channel exceeds a predetermined amount, for example, by determining whether one or more 20 MHz regions to be used is available. *See, e.g.*, **26.5.2.5 UL MU CS mechanism** The ED-based CCA and virtual CS functions are used to determine the state of the medium if CS is required before responding to a received Trigger frame. ED-based CCA for the UL MU CS mechanism is defined in 27.3.20.6.4, and virtual CS is defined in 10.3.2.1. **26.5.2 UL MU operation** **26.5.2.1 General** UL MU operation allows an AP to solicit simultaneous immediate response frames from one or more non-AP HE STAs. A non-AP HE STA shall follow the rules in this subclause for the transmission of response frames in an HE TB PPDU, unless the Trigger frame is an MU-RTS Trigger frame, in which case the response is a CTS frame sent in a non-HT PPDU (see 26.2.6).

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	If the CS Required subfield in a Trigger frame is 1, then the non-AP STA shall consider the status of the CCA [using energy detect defined in 27.3.20.6.2 and the virtual carrier sense (NAV)] during the SIFS between the Trigger frame and the PPDU sent in response to the Trigger frame. In this case, the non-AP STA shall sense the medium using energy detect after receiving the PPDU that contains the Trigger frame (i.e., during the SIFS), and it shall perform the energy detect at least in the subchannel that contains the non-AP STA's UL allocation, where the sensed subchannel consists of one or more 20 MHz channels. The non-AP STA may transmit the solicited PPDU if the 20 MHz channels containing the RUs allocated in the Trigger frame are considered idle. If the non-AP STA detects that the 20 MHz channels containing the allocated RUs are not all idle, then the non-AP STA shall not transmit. NOTE 5—The solicited PPDU is a non-HT or non-HT duplicate PPDU if the Trigger frame is an MU-RTS Trigger frame (see 26.2.6); otherwise, the solicited PPDU is an HE TB PPDU (see 26.5.2.3). The CS Required subfield in the MU-RTS Trigger frame shall be set to 1. An AP that transmits a Basic, BSRP, MU-BAR, BQRP, or GCR MU-BAR Trigger frame shall set the CS Required subfield to 1, unless one of the following conditions is met: — The RA of the Trigger frame is an individually addressed non-AP STA's MAC address, a QoS Data frame with HETP Ack ack policy and/or a Management frame that solicits an acknowledgment is aggregated with the Trigger frame in an A-MPDU, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418. — The Trigger frame is either an MU-BAR or a GCR MU-BAR Trigger frame, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418. — The UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 76. **Source:** IEEE 802.11 ax, Page 341, and 357 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

27.3.20.6 CCA sensitivity

27.3.20.6.1 General

The thresholds in 27.3.20.6 are compared with the signal level at each receiving antenna.

27.3.20.6.2 CCA sensitivity for operating classes requiring CCA-ED

For the operating classes requiring CCA-Energy Detect (CCA-ED), the PHY shall indicate a medium busy condition if CCA-ED detects a channel busy condition. For improved spectrum sharing, CCA-ED is required in some bands. The behavior class indicating CCA-ED is given in Table D-2. The operating classes requiring the corresponding CCA-ED behavior class are given in E.1. The PHY of a STA that is operating within an operating class that requires CCA-ED shall operate with CCA-ED.

CCA-ED for a STA that is attempting a non-preamble puncturing transmission shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for the primary 20 MHz channel, dot11OFDMEDThreshold for the secondary 20 MHz channel (if present), dot11OFDMEDThreshold + 3 dB for the secondary 40 MHz channel (if present), and dot11OFDMEDThreshold + 6 dB for the secondary 80 MHz channel (if present). The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5.

CCA-ED for a STA that is attempting a preamble puncturing transmission shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for the primary 20 MHz channel and dot11OFDMEDThreshold for each nonprimary 20 MHz subchannel. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5.

For the HE TB PPDU transmission, for each of 20 MHz sub-channels that require CCA, CCA-ED shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5.

For transmissions that carry a frame that includes a BQR Control subfield (see 9.2.4.6a), CCA-ED shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for primary 20 MHz channel and dot11OFDMEDThreshold for each nonprimary 20 MHz channel (if present). The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5.

NOTE—The requirement to detect a channel busy condition as stated in 27.3.20.6.3 and 27.3.20.6.4 is a mandatory energy detect requirement on all Clause 27 receivers. Support for CCA-ED is an additional requirement that relates specifically to the sensitivities described in D.2.5.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

Source: IEEE 802.11 ax, Page 644 and 645 of 766.

27. High-efficiency (HE) PHY specification

27.1 Introduction

27.1.1 Introduction to the HE PHY

Clause 27 specifies the PHY entity for a high-efficiency (HE) orthogonal frequency division multiplexing (OFDM) system. In addition to the requirements in Clause 27, an HE STA shall be capable of transmitting and receiving PPDUs that are compliant with the mandatory requirements of the following PHY specifications:

- Clause 19 and Clause 21 if the HE STA supports an operating channel width greater than or equal to 80 MHz and is operating in the 5 GHz band.
- Clause 19 and Clause 21 transmission and reception on 20 MHz channel width (see 26.17.1) if the HE STA is a 20 MHz-only non-AP HE STA and is operating in the 5 GHz band.
- Clause 19 if the HE STA is operating in the 2.4 GHz band.
- Clause 17 if the HE STA is operating in the 6 GHz band.

For 2.4 GHz band operation, the HE PHY is based on HT PHY defined in Clause 19, which in turn is based on the OFDM PHY defined in Clause 17.

For 5 GHz band operation, the HE PHY is based on the VHT PHY defined in Clause 21, which in turn is based on the HT PHY defined in Clause 19, which in turn is further based on the OFDM PHY defined in Clause 17.

For 6 GHz band operation, the HE PHY is based on the OFDM PHY defined in Clause 17.

Source: IEEE 802.11 ax, Page 465 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	According to 802.11ax, all HE STAs (terminals supporting Wi-Fi 6) must comply with Clause 27. Clause 27 requires that all HE STAs implement the Multiuser Carrier Sense mechanism, which defines an energy detection (ED)-based Clear Channel Assessment (CCA) technique. This clause refers to the HE PHY specification, which is followed by all Wi-Fi 6 compliant devices, including smartphones like the iPhone 16 that support Wi-Fi 6. According to 802.11ax, an AP sends a trigger frame to the STAs, and if the CS required subfield in the trigger frame is set to 1, the STA must check the status of the CCA. The STA senses the CCA Energy Detect (CCA-ED) and compares it to the CCA-ED threshold. **27.3.20.6.3 CCA sensitivity for the primary 20 MHz channel** An HE STA with a *W* MHz operating channel width shall detect, with > 90% probability, the start of a PPDU that occupies at least the primary 20 MHz channel in an otherwise idle *W* MHz channel width and issue a PHY-CCA.indication with the STATUS parameter set to BUSY within a period of aCCATime (see 21.4.4) if one of the following conditions is met: — The start of a non-HT PPDU as defined in 17.3.10.6 if operating in the 5 GHz or 6 GHz band and 18.4.6 if operating in the 2.4 GHz band. — The start of an HT PPDU as defined in 19.3.19.5. — The start of a non-HT duplicate, VHT or HE PPDU for which the power measured within the primary 20 MHz channel is at or above –82 dBm. The channel-list parameter is present and set to {primary} if the operating channel width is greater than 20 MHz. The CCA signal shall be held busy (not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE) for the duration of the PPDU, unless it receives a CCARESET.request primitive before the end of the PPDU, for instance, during spatial reuse operation as described in 26.10. The receiver shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY for any signal that exceeds a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (–82 + 20 = –62 dBm) in the primary 20 MHz channel within a period of aCCATime after the signal arrives at the receiver's antenna(s). If the operating channel width is greater than 20 MHz, then the channel-list

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

parameter is present and shall be set to {primary}. Following the indication and while the threshold continues to be exceeded, the receiver shall not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE or with a change in the channel-list parameter.

Source: IEEE 802.11 ax, Page 645 and 646 of 766.

27.3.20.6.5 Per 20 MHz CCA sensitivity

If the operating channel width is greater than 20 MHz and the PHY issues a PHY-CCA.indication primitive, the PHY shall set the per20bitmap to indicate the busy/idle status of each 20 MHz subchannel. A 20 MHz subchannel is busy if at least one of the following conditions is present in an otherwise idle 40 MHz, 80 MHz, 80+80 MHz, or 160 MHz channel:

— A signal is present on the 20 MHz subchannel at or above a threshold of –62 dBm at the receiver's antenna(s). The PHY shall indicate that the 20 MHz subchannel is busy a period aCCATime after the signal starts and shall continue to indicate the 20 MHz subchannel is busy while the threshold continues to be exceeded.

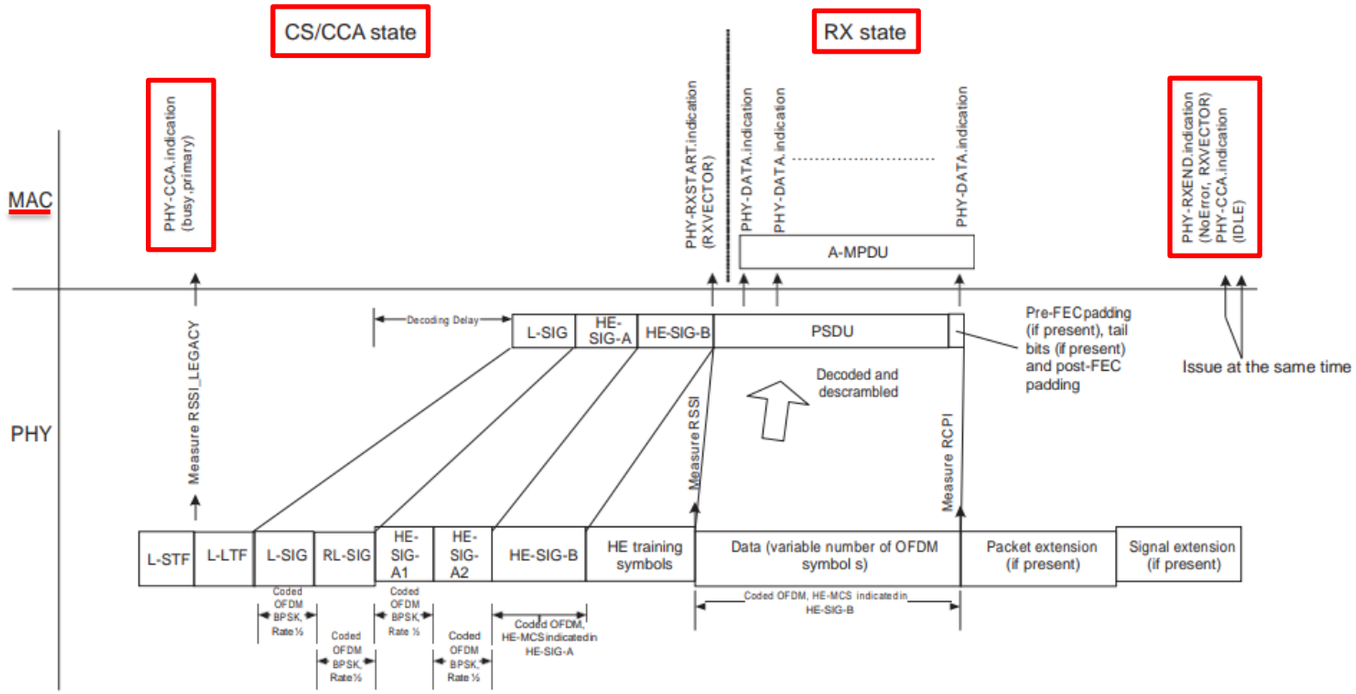
— The 20 MHz subchannel is in a channel on which an 80 MHz non-HT duplicate, VHT or HE PPDU at or above max(–69 dBm, $OBSS\_PD_{level}$ + 6 dB) at the receiver's antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4).

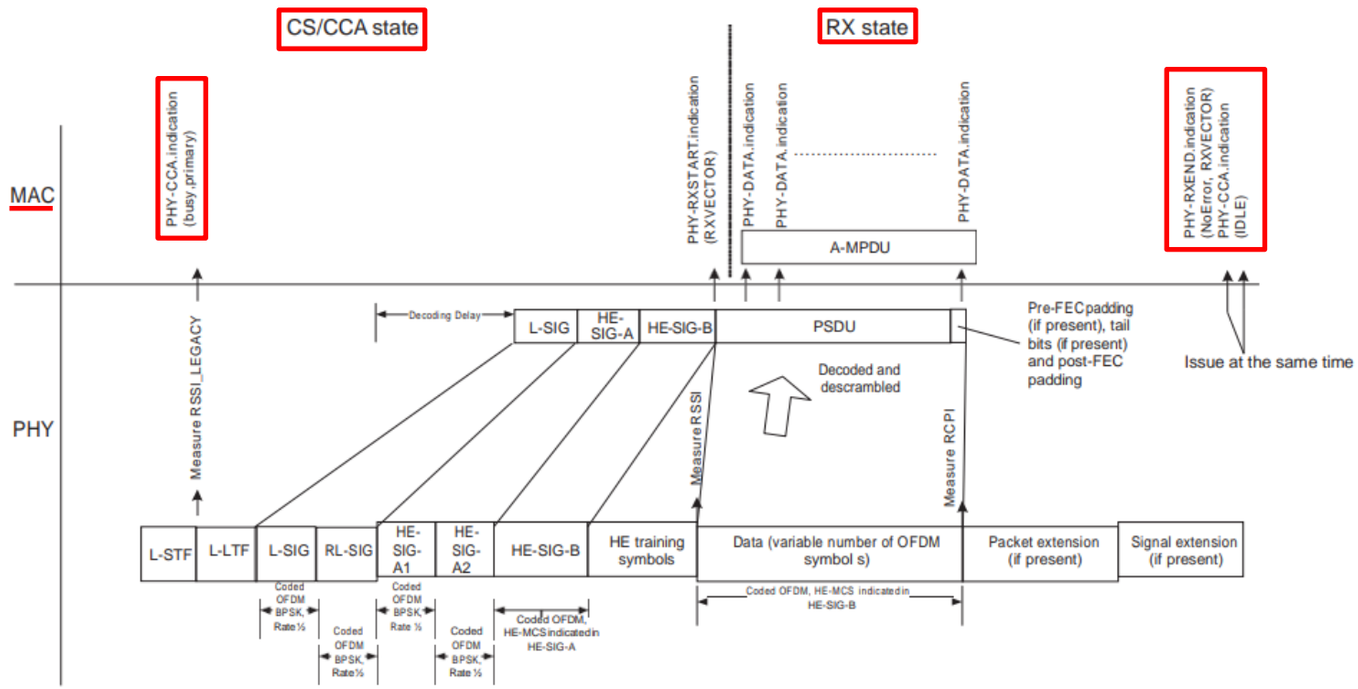
— The 20 MHz subchannel is in a channel on which a 40 MHz non-HT duplicate, HT_MF, HT_GF, VHT or HE PPDU at or above max(–72 dBm, $OBSS\_PD_{level}$ + 3 dB) at the receiver's antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4).

— A 20 MHz non-HT, HT_MF, HT_GF, VHT, or HE PPDU at or above max(–72 dBm, $OBSS\_PD_{level}$) at the receiver's antenna(s) is present on the 20 MHz subchannel. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4).

Source: IEEE 802.11ax-0221, Page 647.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
[26B] a component generating and processing network data packets;	The Wi-Fi 6 (and later) client devices sold by AT&T each include a component (e.g., a processor and associated software implementing a portion of the Wi-Fi 6 MAC-layer functionality on the devices) for generating and processing network data packets, which includes the Wi-Fi 6 (and later). According to 802.11ax, the MAC (Medium Access Control) is responsible for carrier sensing and Clear Channel Assessment (CCA). Based on the PHY-CCA signal indication, the MAC generates and processes network data packets accordingly. *See, e.g.*, **5. MAC service definition** **5.1 Overview of MAC services** **5.1.1 Data service** **5.1.1.1 General** This service provides peer LLC sublayer entities or IEEE 802.1Q bridge ports with the ability to exchange MSDUs. To support this service, the local MAC uses the underlying PHY-level services to transport an MSDU to a peer MAC entity, where it is delivered to the peer LLC sublayer or bridge port. Such asynchronous MSDU transport is performed on a connectionless basis. By default, MSDU transport is on a best-effort basis. However, the QoS facility uses a traffic identifier (TID) to specify differentiated services on a per-MSDU basis. The QoS facility also permits more synchronous behavior to be supported on a connection-oriented basis using TSPECs. There are no guarantees that the submitted MSDU will be delivered successfully. Group addressed transport is part of the data service provided by the MAC. Due to the characteristics of the WM, group addressed MSDUs might experience a lower QoS, compared to that of individually addressed MSDUs. All STAs support the data service, but only QoS STAs in a QoS BSS differentiate their MSDU delivery according to the designated traffic category or traffic stream (TS) of individual MSDUs. QoS STAs that support the QMF service differentiate their MMPDU delivery according to the MMPDU's access category. The access category of each MMPDU is designated by the transmitter's current QMF policy. **Source:** 802.11-2020 at p. 294.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	 **Figure 27-61—PHY receive procedure for an HE MU PPDU** **Source:** IEEE 802.11 ax, Page 653 of 766.
[26C] control subsystem that accepts said network data packets from said component and	The Wi-Fi 6 (and later) client devices sold by AT&T each include a control subsystem (e.g., a processor and associated software for implementing portions of the Wi-Fi 6 MAC and/or PHY layer functionality on the devices that determines a manner in which to transmit packets) that accepts said network data packets from said component

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
determines a manner in which to transmit said network data packets over said communication channel; and	and determines a manner in which to transmit said network data packets over said communication channel. According to 802.11ax, based on the generated network data packets, the controlling STA operates as follows: if the CCA indication is BUSY, the STA will back off and avoid transmitting the packets; if the CCA indication is IDLE, the STA will proceed with the transmission of the packets.  **Figure 27-61—PHY receive procedure for an HE MU PPDU** **Source:** IEEE 802.11 ax, Page 653 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

27.3.20.6.3 CCA sensitivity for the primary 20 MHz channel

An HE STA with a *W* MHz operating channel width shall detect, with > 90% probability, the start of a PPDU that occupies at least the primary 20 MHz channel in an otherwise idle *W* MHz channel width and issue a PHY-CCA.indication with the STATUS parameter set to BUSY within a period of aCCATime (see 21.4.4) if one of the following conditions is met:

— The start of a non-HT PPDU as defined in 17.3.10.6 if operating in the 5 GHz or 6 GHz band and 18.4.6 if operating in the 2.4 GHz band.

— The start of an HT PPDU as defined in 19.3.19.5.

— The start of a non-HT duplicate, VHT or HE PPDU for which the power measured within the primary 20 MHz channel is at or above –82 dBm.

The channel-list parameter is present and set to {primary} if the operating channel width is greater than 20 MHz. The CCA signal shall be held busy (not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE) for the duration of the PPDU, unless it receives a CCARESET.request primitive before the end of the PPDU, for instance, during spatial reuse operation as described in 26.10.

The receiver shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY for any signal that exceeds a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (–82 + 20 = –62 dBm) in the primary 20 MHz channel within a period of aCCATime after the signal arrives at the receiver's antenna(s). If the operating channel width is greater than 20 MHz, then the channel-list parameter is present and shall be set to {primary}. Following the indication and while the threshold continues to be exceeded, the receiver shall not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE or with a change in the channel-list parameter.

Source: IEEE 802.11 ax, Page 645 and 646 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	27.3.20.6.5 Per 20 MHz CCA sensitivity If the operating channel width is greater than 20 MHz and the PHY issues a PHY-CCA.indication primitive, the PHY shall set the per20bitmap to indicate the busy/idle status of each 20 MHz subchannel. A 20 MHz subchannel is busy if at least one of the following conditions is present in an otherwise idle 40 MHz, 80 MHz, 80+80 MHz, or 160 MHz channel: — A signal is present on the 20 MHz subchannel at or above a threshold of –62 dBm at the receiver's antenna(s). The PHY shall indicate that the 20 MHz subchannel is busy a period aCCATime after the signal starts and shall continue to indicate the 20 MHz subchannel is busy while the threshold continues to be exceeded. — The 20 MHz subchannel is in a channel on which an 80 MHz non-HT duplicate, VHT or HE PPDU at or above max(–69 dBm, $OBSS\_PD_{level}$ + 6 dB) at the receiver's antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4). — The 20 MHz subchannel is in a channel on which a 40 MHz non-HT duplicate, HT_MF, HT_GF, VHT or HE PPDU at or above max(–72 dBm, $OBSS\_PD_{level}$ + 3 dB) at the receiver's antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4). — A 20 MHz non-HT, HT_MF, HT_GF, VHT, or HE PPDU at or above max(–72 dBm, $OBSS\_PD_{level}$) at the receiver's antenna(s) is present on the 20 MHz subchannel. The PHY shall indicate that the 20 MHz subchannel is busy with > 90% probability within a period aCCAMidTime (see 27.4.4). **Source:** IEEE 802.11ax-0221, Page 647.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

If the CS Required subfield in a Trigger frame is 1, then the non-AP STA shall consider the status of the CCA [using energy detect defined in 27.3.20.6.2 and the virtual carrier sense (NAV)] during the SIFS between the Trigger frame and the PPDU sent in response to the Trigger frame. In this case, the non-AP STA shall sense the medium using energy detect after receiving the PPDU that contains the Trigger frame (i.e., during the SIFS), and it shall perform the energy detect at least in the subchannel that contains the non-AP STA's UL allocation, where the sensed subchannel consists of one or more 20 MHz channels. The non-AP STA may transmit the solicited PPDU if the 20 MHz channels containing the RUs allocated in the Trigger frame are considered idle. If the non-AP STA detects that the 20 MHz channels containing the allocated RUs are not all idle, then the non-AP STA shall not transmit.

NOTE 5—The solicited PPDU is a non-HT or non-HT duplicate PPDU if the Trigger frame is an MU-RTS Trigger frame (see 26.2.6); otherwise, the solicited PPDU is an HE TB PPDU (see 26.5.2.3).

The CS Required subfield in the MU-RTS Trigger frame shall be set to 1.

An AP that transmits a Basic, BSRP, MU-BAR, BQRP, or GCR MU-BAR Trigger frame shall set the CS Required subfield to 1, unless one of the following conditions is met:

— The RA of the Trigger frame is an individually addressed non-AP STA's MAC address, a QoS Data frame with HETP Ack ack policy and/or a Management frame that solicits an acknowledgment is aggregated with the Trigger frame in an A-MPDU, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418.

— The Trigger frame is either an MU-BAR or a GCR MU-BAR Trigger frame, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418.

— The UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 76.

Source: IEEE 802.11 ax, Page 357 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	According to 802.11ax, a non-AP STA is permitted to send an HE TB PPDU after a SIFS period following the reception of a PPDU, if the following conditions are met: 1) The received PPDU includes a Trigger frame, 2) Either the CS Required subfield in the Trigger frame is set to 1 and the UL MU CS condition shows the medium is idle, or the CS Required subfield is set to 0. **26.5.2.3 Non-AP STA behavior for UL MU operation** A non-AP STA shall not transmit an HE TB PPDU if all of the conditions in 26.5.2.3.2 are satisfied. Otherwise, a non-AP STA shall transmit an HE TB PPDU a SIFS after a received PPDU if all of the following conditions are met: — The received PPDU contains either a Trigger frame (that is not an MU-RTS variant) with a User Info field addressed to the non-AP STA or a frame addressed to the non-AP STA that contains an TRS Control subfield. A User Info field in the Trigger frame is addressed to a non-AP STA if one of the following conditions are met: — The CS Required subfield in the Trigger frame is 1, and the UL MU CS condition described in 26.5.2.5 indicates the medium is idle; or the CS Required subfield in a Trigger frame is 0; or the response was solicited by a frame containing a TRS Control subfield. **Source:** IEEE 802.11 ax, Page 349 of 766.
[26D] said control subsystem enabling a plurality of said network data packets to be successfully transmitted simultaneously on said communication channel with other data packets transmitted by at least	The Wi-Fi 6 (and later) client devices sold by AT&T each include a control subsystem (e.g., a processor and associated software for implementing portions of the Wi-Fi 6 MAC and/or PHY layer functionality on the devices) that enables multiple network data packets to be transmitted simultaneously over the communication channel, e.g., via OFDMA and/or MU-MIMO functionality. The client devices implement the Uplink Multiuser Carrier Sense mechanism, which uses energy detection (ED)-based Clear Channel Assessment (CCA). Based on the ED, the device determines whether to transmit or refrain from transmitting data packets over the communication channel.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
one other terminal and, if it has been determined that said signal energy exceeds said predetermined amount, does not allow the terminal to begin to transmit on said communication channel.	According to 802.11ax, a non-AP STA is permitted to transmit an HE TB PPDU after a SIFS period following the reception of a PPDU, provided the following conditions are met: 1) The received PPDU contains a Trigger frame, 2) Either the CS Required subfield in the Trigger frame is set to 1 and the UL MU CS condition indicates that the medium is idle, or the CS Required subfield is set to 0. Additionally, as indicated by the evidence below, data packets are transmitted simultaneously from STAs to the AP. If the UL MU CS condition shows that the medium is busy (i.e., the communication channel exceeds a predetermined threshold), the control subsystem prevents the STA from starting its data transmission. An HE AP sends a Trigger frame to initiate UL MU operation using UL OFDMA or UL MU-MIMO transmissions or a frame containing a TRS Control subfield to initiate UL OFDMA transmissions. The frame initiating these transmissions in the uplink direction is a triggering frame. The triggering frame identifies non-AP STAs participating in UL MU operation and assigns RUs and/or spatial streams to these STAs. Multi-STA BlockAck frames can be used by the AP to acknowledge the frames transmitted by multiple non-AP STAs. The scheduling of these Trigger frames can be set up between a non-AP STA and the AP using TWT operation to save power and reduce collisions. **Source:** 802.11ax-2021 at p. 48.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

27.3.1.2 OFDMA

OFDMA is an OFDM-based multiple access scheme where different subsets of subcarriers are allocated to different users, and this scheme allows simultaneous data transmission to or from one or more users. In OFDMA, users are allocated different subsets of subcarriers that can change from one PPDU to the next. The difference between OFDM and OFDMA is illustrated in Figure 27-4. Similar to OFDM, OFDMA employs multiple subcarriers, but the subcarriers are divided into several groups where each group is referred to as an RU. With OFDMA, different transmit powers may be applied to different RUs.

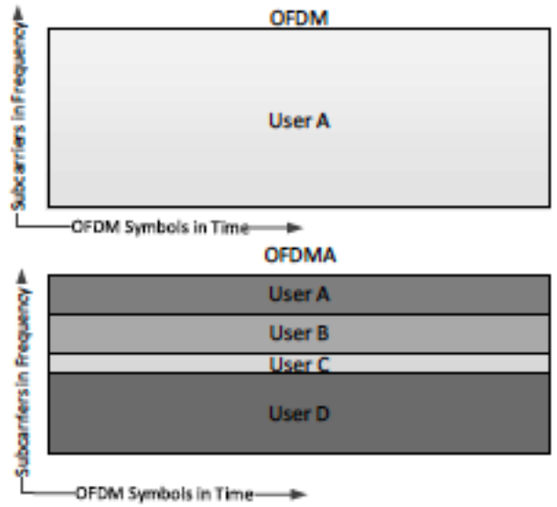


Figure 27-4—Illustration of OFDM and OFDMA concepts

Source: 802.11ax-2021 at p. 497

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

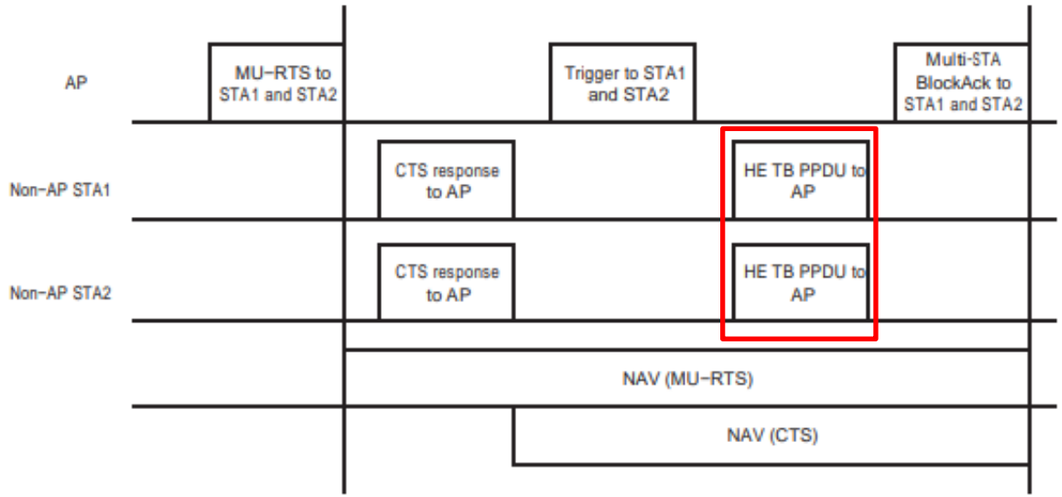


Figure 26-2—Example of MU-RTSICTSITriggerIHE TB PPDUIMulti-STA BlockAck and NAV setting

Source: IEEE 802.11 ax, Page 317 of 766.

26.5.2.3 Non-AP STA behavior for UL MU operation

A non-AP STA shall not transmit an HE TB PPDU if all of the conditions in 26.5.2.3.2 are satisfied. Otherwise, a non-AP STA shall transmit an HE TB PPDU a SIFS after a received PPDU if all of the following conditions are met:

— The received PPDU contains either a Trigger frame (that is not an MU-RTS variant) with a User Info field addressed to the non-AP STA or a frame addressed to the non-AP STA that contains an TRS Control subfield. A User Info field in the Trigger frame is addressed to a non-AP STA if one of the following conditions are met:

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

— The CS Required subfield in the Trigger frame is 1, and the UL MU CS condition described in 26.5.2.5 indicates the medium is idle; or the CS Required subfield in a Trigger frame is 0; or the response was solicited by a frame containing a TRS Control subfield.

Source: IEEE 802.11 ax, Page 349 of 766.

If the CS Required subfield in a Trigger frame is 1, then the non-AP STA shall consider the status of the CCA [using energy detect defined in 27.3.20.6.2 and the virtual carrier sense (NAV)] during the SIFS between the Trigger frame and the PPDU sent in response to the Trigger frame. In this case, the non-AP STA shall sense the medium using energy detect after receiving the PPDU that contains the Trigger frame (i.e., during the SIFS), and it shall perform the energy detect at least in the subchannel that contains the non-AP STA's UL allocation, where the sensed subchannel consists of one or more 20 MHz channels. The non-AP STA may transmit the solicited PPDU if the 20 MHz channels containing the RUs allocated in the Trigger frame are considered idle. If the non-AP STA detects that the 20 MHz channels containing the allocated RUs are not all idle, then the non-AP STA shall not transmit.

NOTE 5—The solicited PPDU is a non-HT or non-HT duplicate PPDU if the Trigger frame is an MU-RTS Trigger frame (see 26.2.6); otherwise, the solicited PPDU is an HE TB PPDU (see 26.5.2.3).

The CS Required subfield in the MU-RTS Trigger frame shall be set to 1.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

An AP that transmits a Basic, BSRP, MU-BAR, BQRP, or GCR MU-BAR Trigger frame shall set the CS Required subfield to 1, unless one of the following conditions is met:

— The RA of the Trigger frame is an individually addressed non-AP STA's MAC address, a QoS Data frame with HETP Ack ack policy and/or a Management frame that solicits an acknowledgment is aggregated with the Trigger frame in an A-MPDU, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418.

— The Trigger frame is either an MU-BAR or a GCR MU-BAR Trigger frame, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418.

— The UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 76.

Source: IEEE 802.11 ax, Page 357 of 766.

27.3.20.6 CCA sensitivity

27.3.20.6.1 General

The thresholds in 27.3.20.6 are compared with the signal level at each receiving antenna.

27.3.20.6.2 CCA sensitivity for operating classes requiring CCA-ED

For the operating classes requiring CCA-Energy Detect (CCA-ED), the PHY shall indicate a medium busy condition if CCA-ED detects a channel busy condition. For improved spectrum sharing, CCA-ED is required in some bands. The behavior class indicating CCA-ED is given in Table D-2. The operating classes

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	requiring the corresponding CCA-ED behavior class are given in E.1. The PHY of a STA that is operating within an operating class that requires CCA-ED shall operate with CCA-ED. CCA-ED for a STA that is attempting a non-preamble puncturing transmission shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for the primary 20 MHz channel, dot11OFDMEDThreshold for the secondary 20 MHz channel (if present), dot11OFDMEDThreshold + 3 dB for the secondary 40 MHz channel (if present), and dot11OFDMEDThreshold + 6 dB for the secondary 80 MHz channel (if present). The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5. CCA-ED for a STA that is attempting a preamble puncturing transmission shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for the primary 20 MHz channel and dot11OFDMEDThreshold for each nonprimary 20 MHz subchannel. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5. For the HE TB PPDU transmission, for each of 20 MHz sub-channels that require CCA, CCA-ED shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5. For transmissions that carry a frame that includes a BQR Control subfield (see 9.2.4.6a), CCA-ED shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for primary 20 MHz channel and dot11OFDMEDThreshold for each nonprimary 20 MHz channel (if present). The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5. NOTE—The requirement to detect a channel busy condition as stated in 27.3.20.6.3 and 27.3.20.6.4 is a mandatory energy detect requirement on all Clause 27 receivers. Support for CCA-ED is an additional requirement that relates specifically to the sensitivities described in D.2.5. **Source:** IEEE 802.11 ax, Page 644 and 645 of 766
[44Pre] A method for transmitting network data packets, said method comprising the steps of:	[*See* claim element 1A with respect to how Wi-Fi 6 (and later) AT&T client devices satisfy this claim limitation.] **Wi-Fi 5 (and later) APs** Additionally, AT&T provides Internet service with Wi-Fi including routers and access points (collectively, "access points", "access point stations (STAs)" or "APs") that perform a method for transmitting data packets via downlink multi-user MIMO according to 802.11ac and later standards. The IEEE 802.11ac WLAN standard is collectively

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	composed of the 802.11ac amendment (herein referred to as "Wi-Fi 5" or "802.11ac") to the 802.11 standard (herein referred to as "802.11-2021"). Wi-Fi 5 (and later) APs perform a method for transmitting network data packets. As shown in the below cites in MU-MIMO, as implemented by 802.11ac, APs transmitting network data packets, such as "Very High Throughput" multiuser packets known as "VHT MU PPDUs." 802.11 clarifies that in the MAC layer, MSDU(s) are encapsulated and may be aggregated into an A-MPDU by the MAC data service architecture. Thus, during a transmission, the frame that leaves the MAC layer and enters the PHY layer can be an A-MPDU (which contains one or more MSDUs). An A-MPDU obtained from the MAC data service architecture is transmitted at the PHY in a PSDU frame. In an 802.11ac PHY layer, the PSDU is encapsulated in a PPDU for transmission by the PHY. **802.11-2021** **5. MAC service definition** **5.1 Overview of MAC services** **5.1.1 Data service** **5.1.1.1 General** This service provides peer LLC entities with the ability to exchange MSDUs. To support this service, the local MAC uses the underlying PHY-level services to transport an MSDU to a peer MAC entity, where it is delivered to the peer LLC. … **5.1.5 MAC data service architecture** **5.1.5.1 General** The MAC data plane architecture (i.e., processes that involve transport of all or part of an MSDU) is shown in Figure 5-1. …

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	During transmission, an MSDU goes through the processes shown in the left-hand side of Figure 5-1. When transparent FST is used, an MSDU first goes, as shown in Figure 5-2, through an additional transparent FST entity that contains a demultiplexing process that forwards the MSDU down to the selected TX MSDU Rate Limiting process and from there to MAC data plane processing as described in the previous sentence. IEEE Std 802.1X-2010 may block the MSDU at the Controlled Port before the preceding processing occurs. Otherwise, at some point, the Data frames that contain all or part of the MSDU are queued per AC/TS.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

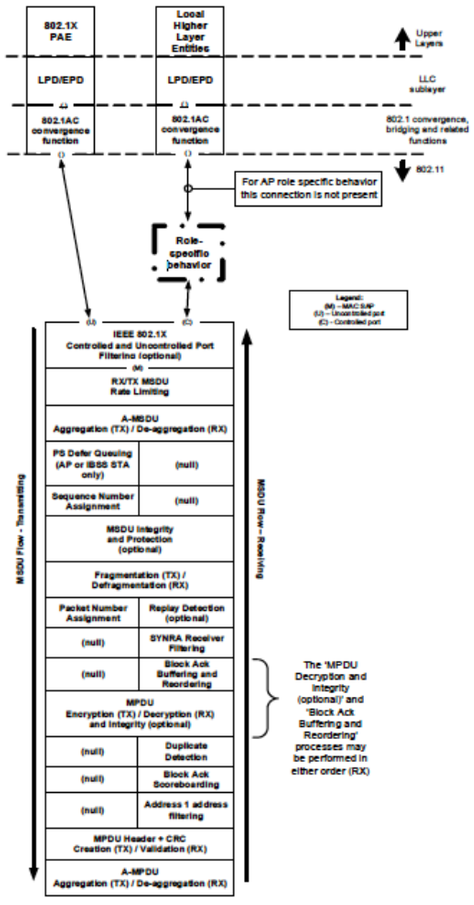


Figure 5-1—MAC data plane architecture

10.12.5 Transport of A-MPDU by the PHY data service

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	An A-MPDU shall be transmitted in a PSDU associated with a PHY-TXSTART.request primitive with the TXVECTOR parameter AGGREGATION set to 1 or the TXVECTOR parameter FORMAT set to VHT. A received PSDU is determined to be an A-MPDU when the associated PHY-RXSTART.indication primitive RXVECTOR parameter AGGREGATION is equal to 1 or the RXVECTOR parameter FORMAT is equal to VHT. **3.1 Definitions** **beamformee:** A station (STA) that receives a physical layer convergence procedure (PLCP) protocol data unit (PPDU) that was transmitted using a beamforming steering matrix. **beamformer:** A station (STA) that transmits a physical layer convergence procedure (PLCP) protocol data unit (PPDU) using a beamforming steering matrix. **802.11ac** **22.1.2 Scope** The services provided to the MAC by the VHT PHY consist of the following protocol functions: a) A function that defines a method of mapping the PSDUs into a framing format (PPDU) suitable for sending and receiving PSDUs between two or more STAs. b) A function that defines the characteristics and method of transmitting and receiving data through a wireless medium between two or more STAs. Depending on the PPDU format, these STAs support a mixture of VHT: Clause 20 and Clause 18 PHYs. **22.1.3 VHT PHY functions** **22.1.3.1 General** The VHT PHY contains two functional entities: the PHY function and the physical layer management function (i.e., the PLME). Both of these functions are described in detail in 22.3 and 22.4.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	22.3 VHT PHY layer **22.3.1 Introduction** This subclause provides the procedure by which PSDUs are converted to and from transmissions on the wireless medium. During transmission, a PSDU (in the SU case) or one or more PSDUs (in the MU case) are processed (i.e., scrambled and coded) and appended to the PHY preamble to create the PPDU. At the receiver, the PHY preamble is processed to aid in the detection, demodulation, and delivery of the PSDU. **22.1.4 PPDU formats** The structure of the PPDU transmitted by a VHT STA is determined by the TXVECTOR parameters as defined in Table 22-1. For a VHT STA, the FORMAT parameter determines the overall structure of the PPDU and includes the following: — Non-HT format (NON_HT), based on Clause 18 and including non-HT duplicate format. — HT-mixed format (HT_MF) as specified in Clause 20. — HT-greenfield format (HT_GF) as specified in Clause 20. — VHT format (VHT). PPDUs of this format contain a preamble compatible with Clause 18 and Clause 20 STAs. The non-VHT portion of the VHT format preamble (the parts of VHT preamble preceding the VHT-SIG-A field) is defined so that it can be decoded by these STAs. NOTE—Required support for these formats is defined in 10.39, 20.1.1, and 22.1.1. A VHT PPDU can be further categorized as a VHT SU PPDU or a VHT MU PPDU. A VHT PPDU using a group ID value of 0 or 63 is a VHT SU PPDU and either carries only one PSDU or no PSDU. A VHT PPDU using a group ID value in the range of 1 to 62 is a VHT MU PPDU and carries one or more PSDUs to one or more users.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
[44A] sensing a communication channel, by a monitoring subsystem in a terminal, to determine whether signal energy on said communication channel exceeds a predetermined amount; and	[See claim element 1B with respect to how Wi-Fi 6 (and later) AT&T client devices satisfy this claim limitation.] **Wi-Fi 5 (and later) APs** Additionally, Wi-Fi 5 (and later) APs provided by AT&T include a monitoring subsystem (e.g., hardware and associated software implementing portions of the Wi-Fi 5 physical layer that monitor signal energy on a communication channel) that senses a communication channel (e.g., determining the "state of the medium" using the CCA function in the PHY layer) to determine whether signal energy on said communication channel exceeds a predetermined amount. See, Table 22-27 (below), which defines the predetermined amount of signal energy measured in units of dBm by the receiving antenna of the device that must be exceeded for the channel to be designated as busy or idle. The "predetermined amount" and "signal energy" are satisfied by the CCA sensitivity described in the 802.11ac at 22.3.19.5 (below). The CCA function is defined as the "logical function in the physical layer (PHY) that determines the current state of use of the wireless medium (WM)" according to 802.11 at 3.1 Definition. When the STA wishes to transmit, it calls the PHY primitive 7.3.5.11, for which the CCA values governing a BUSY and IDLE are described in 802.11ac at 22.3.19.5. The enhanced distributed channel access (EDCA) protocol of 802.11 includes a carrier sense multiple access with collision avoidance (CSMA/CA) protocol that is the 802.11 MAC as defined in 802.11 9.2 MAC architecture. More specifically, see 802.11 9.3 DCF regarding the use of the DCF communications channel by 802.11. The "signal energy level" and "predetermined amount" may vary with the physical layer and the channel width used in the transmission. For 802.11ac (e.g., VHT PHY), Section 22 of 802.11ac provides these specifications. For

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	example, Table 22-27 Conditions for CCA BUSY on the primary 20 MHz in 802.11ac in 802.11ac22.3.19.5 CCA sensitivity provides dBm values with which 802.11 devices abide. **802.11-2021** **3.1 Definitions** **clear channel assessment (CCA) function:** That logical function in the physical layer (PHY) that determines the current state of use of the wireless medium (WM). **10. MAC sublayer functional description** **10.1 Introduction** The MAC functional description is presented in this clause. The architecture of the MAC sublayer, including the distributed coordination function (DCF)… **10.2.2 DCF** The fundamental access method of the MAC used by non-DMG STAs is a DCF known *as carrier sense multiple access with collision avoidance* (CSMA/CA). The DCF shall be implemented in all STAs. For a STA to transmit, it shall sense the medium to determine if another STA is transmitting. If the medium is not determined to be busy (see 10.3.2.1), the transmission may proceed. **10.3.2.1 CS mechanism** Physical and virtual CS functions are used to determine the state of the medium. When either function indicates a busy medium, the medium shall be considered busy; otherwise, it shall be considered idle. A physical CS mechanism shall be provided by the PHY. See Clause 8 for how this information is conveyed to the MAC. The details of physical CS are provided in the individual PHY specifications.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

8.3.4.3 PHY SAP service primitives parameters

Table 8-3—PHY SAP service primitive parameters

Parameter	Associated primitive	Value
DATA	PHY-DATA.request PHY-DATA.indication	Octet value X'00'–X'FF'
TXVECTOR	PHY-TXSTART.request	A set of parameters
STATE	PHY-CCA.indication	(BUSY, [channel-list]) (IDLE)
RXVECTOR	PHY-RXSTART.indication	A set of parameters
RCPI	PHY-RXEND.indication	Clauses 15–19 and 21–23: 0–255; Clauses 20, 24, and 25: not present
RXERROR	PHY-RXEND.indication	NoError, FormatViolation, CarrierLost, UnsupportedRate, Filtered
IPI-STATE	PHY-CCARESET.request PHY-CCARESET.confirm	IPI-ON, IPI-OFF
IPI-REPORT	PHY-CCA.indication PHY-CCARESET.confirm	A set of IPI values for the preceding time interval

8.3.5.12 PHY-CCA.indication

8.3.5.12.1 Function

This primitive is an indication by the PHY to the local MAC entity of the current state of the medium and to provide observed IPI values when IPI reporting is turned on.

8.3.5.12.2 Semantics of the service primitive

The primitive provides the following parameters:

PHY-CCA.indication(

STATE,

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	IPI-REPORT, channel-list) The STATE parameter can be one of two values: BUSY or IDLE. The parameter value is BUSY if the assessment of the channel(s) by the PHY determines that the channel(s) are not available. Otherwise, the value of the parameter is IDLE. **802.11ac** **22.3.19 VHT receiver specification** For tests in this subclause, the input levels are measured at the antenna connectors and are referenced as the average power per receive antenna. The number of spatial streams under test shall be equal to the number of utilized transmitting STA antenna (output) ports and also equal to the number of utilized Device Under Test input ports. Each output port of the transmitting STA shall be connected through a cable to one input port of the Device Under Test. **22.3.19.5 CCA sensitivity** **22.3.19.5.1 General** The thresholds in this subclause are compared with the signal level at each receiving antenna. **22.3.19.5.2 CCA sensitivity for operating classes requiring CCA-ED** For the operating classes requiring CCA-Energy Detect (CCA-ED), CCA shall also detect a medium busy condition when CCA-ED detects a channel busy condition. . . .

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	NOTE—The requirement to issue a CCA signal busy as stated in 22.3.19.5.3 and 22.3.19.5.4 is a mandatory energy detect requirement on all Clause 22 receivers. Support for CCA-ED is an additional requirement that relates specifically to the sensitivities described in D.2.5. **22.3.19.5.3 CCA sensitivity for signals occupying the primary 20 MHz channel** The PHY shall issue a PHY-CCA.indication(BUSY, {primary}) if one of the conditions listed in Table 22- 27 is met in an otherwise idle 20 MHz, 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz operating channel width. With >90% probability, the PHY shall detect the start of a PPDU that occupies at least the primary 20 MHz channel under the conditions listed in Table 22-27 within a period of aCCATime (see 22.4.4) and hold the CCA signal busy (PHY_CCA.indicate(BUSY, channel-list)) for the duration of the PPDU. The receiver shall issue a PHY-CCA.indication(BUSY, {primary}) for any signal that exceeds a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (–82 + 20 = –62 dBm) in the primary 20 MHz channel within a period of aCCATime after the signal arrives at the receiver's antenna(s); then the receiver shall not issue a PHY CCA.indication(BUSY, {secondary}), PHYCCA. indication(BUSY,{secondary40}), PHY-CCA.indication (BUSY,{secondary80}), or PHYCCA. indication(IDLE) while the threshold continues to be exceeded.

<table>
<tr><th>Claim</th><th>Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)</th></tr>
<tr><td></td><td>Table 22-27—Conditions for CCA BUSY on the primary 20 MHz
<table><tr><th>Operating Channel Width</th><th>Conditions</th></tr><tr><td>20 MHz, 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz</td><td>The start of a 20 MHz NON_HT PPDU in the primary 20 MHz channel as defined in 18.3.10.6.
The start of an HT PPDU under the conditions defined in 20.3.21.5.
The start of a 20 MHz VHT PPDU in the primary 20 MHz channel at or above –82 dBm.</td></tr><tr><td>40 MHz, 80 MHz, 160 MHz, or 80+80 MHz</td><td>The start of a 40 MHz non-HT duplicate or VHT PPDU in the primary 40 MHz channel at or above –79 dBm.
The start of an HT PPDU under the conditions defined in 20.3.21.5.</td></tr><tr><td>80 MHz, 160 MHz, or 80+80 MHz</td><td>The start of an 80 MHz non-HT duplicate or VHT PPDU in the primary 80 MHz channel at or above –76 dBm.</td></tr><tr><td>160 MHz or 80+80 MHz</td><td>The start of a 160 MHz or 80+80 MHz non-HT duplicate or VHT PPDU at or above –73 dBm.</td></tr></table></td></tr>
<tr><td>[44B] if it has been determined that said signal energy exceeds said predetermined amount, said control subsystem prevents the terminal from transmitting on said communication channel;</td><td>[See claim element 26D with respect to how Wi-Fi 6 (and later) AT&T client devices satisfy this claim limitation.]

Wi-Fi 5 (and later) APs
Additionally, Wi-Fi 5 (and later) APs provided by AT&T include a control subsystem (e.g., a processor and associated software for implementing portions of the Wi-Fi 6 MAC and/or PHY layer functionality on the devices that determines a manner in which to transmit packets) that prevents the terminal from transmitting on said communication channel if it has been determined that said signal energy exceeds said predetermined amount. For example, when it is determined that said signal energy exceeds said predetermined amount (as defined in Table 22-27 (above)), the control subsystem (e.g., the DCF implementing function of the MAC layer of the transmitter, for example) prevents the terminal from transmitting on said communication channel (DCF uses a random backoff time following a busy medium condition).</td></tr>
</table>

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	802.11ac **10.3 DCF** **10.3.1 General** The basic medium access protocol is a DCF that allows for automatic medium sharing between compatible PHYs through the use of CSMA/CA and a random backoff count following a busy medium condition. In addition, all individually addressed traffic uses immediate positive acknowledgment (Ack frame), in which retransmission is scheduled by the sender if no Ack frame is received. The CSMA/CA protocol is designed to reduce the collision probability between multiple STAs accessing a medium, at the point where collisions would most likely occur. Just after the medium becomes idle following a busy medium (as indicated by the CS function) is when the highest probability of a collision exists. This is because multiple STAs could have been waiting for the medium to become available again. This is the situation that necessitates a random backoff procedure to resolve medium contention conflicts.
[44C] determining a manner in which to transmit network data packets over said communication channel and enabling a plurality of said network data packets to be transmitted simultaneously on said communication channel, by a control component in the terminal,	[*See* claim elements 1D and 1E with respect to how Wi-Fi 6 (and later) AT&T client devices satisfy this claim limitation.] **Wi-Fi 5 (and later) APs** Additionally, Wi-Fi 5 (and later) APs provided by AT&T include a control component (e.g., a processor and associated software for implementing portions of the Wi-Fi 6 PHY layer functionality on the device that determines a manner in which to transmit packets over the communications channel) that enables a plurality of the network

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
said plurality of said network data packets being successfully transmitted simultaneously over said communication channel;	data packets to be transmitted simultaneously on the communication channel, the plurality of the network data packets being successfully transmitted simultaneously over the communication channel. For example, 802.11ac describes determining a manner in which to transmit network data packets over the communication channel by providing a description of how to steer signals to send VHT MU PPDUs with DL-MU-MIMO beamforming techniques. *See, e.g.*, subclauses 22.3.11.1 to .3, which describes mechanics for how the transmitter "is to steer signals using knowledge of the channel." **802.11ac** **22.1.4 PPDU formats** … A VHT PPDU can be further categorized as a VHT SU PPDU or a VHT MU PPDU. **22.3.11 SU-MIMO and DL-MU-MIMO Beamforming** **22.3.11.1 General** SU-MIMO and DL-MU-MIMO beamforming are techniques used by a STA with multiple antennas (the beamformer) to steer signals using knowledge of the channel to improve throughput. With SU-MIMO beamforming all space-time streams in the transmitted signal are intended for reception at a single STA. With DL-MU-MIMO beamforming, disjoint subsets of the space-time streams are intended for reception at different STAs. …

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	The DL-MU-MIMO steering matrix can be determined by the Qk … can be determined by the beamformer using the beamforming feedback matrices for subcarrier *k* from beamformee *u*, *Vk,u,* and SNR information for subcarrier *k* from beamformee *u*, *SNRk,u*, where . The steering matrix that is computed (or updated) using new beamforming feedback matrices and new SNR information from some or all of participating beamformees might replace the existing steering matrix for the next DL-MU-MIMO data transmission. The beamformee group for the MU transmission is signaled using the Group ID field in VHT-SIG-A (see 22.3.8.3.3 and 22.3.11.4). **22.5 Parameters for VHT-MCSs** The rate-dependent parameters for 20 MHz, 40 MHz, 80 MHz, 160 MHz, and 80+80 MHz are given in Table 22-30 through Table 22-61 . . . Table 22-30 to Table 22-33, Table 22-38 to Table 22-41, Table 22-46 to Table 22-49, and Table 22-54 to Table 22-57 define VHT-MCSs not only for SU transmission but also for user *u* of MU transmission. In the case of VHT-MCSs for MU transmission, the parameters, *NSS*, *R*, *NBPSCS*, *NCBPS*, *NDBPS*, and *NES* are replaced with *NSS,u*, *Ru*, *NBPSCS,u*, *NCBPS,u*, *NDBPS,u*, and *NES,u*, respectively. Furthermore, 802.11ac describes enabling a plurality of said network data packets (e.g., VHT MU PPDUs) to be transmitted simultaneously on said communication channel (e.g., via DL-MU-MIMO), by the control component in the terminal [e.g., at least a portion of the PHY VHT PHY], said plurality of said network data packets (e.g., VHT MU PPDUs) being successfully transmitted simultaneously over said communication channel (e.g. via DL-MU-MIMO Beamforming). With DL-MU-MIMO, a transmitting STA can send to multiple receiving STAs simultaneously, and a receiving STA can receive from multiple transmitting STAs simultaneously. To allow this to occur "successfully", the standard recites use of a VHT MU PPDU, and the sending and receiving STAs are configured to send/receive (respectively) RF signals that are appropriately formed to transmit in a manner that both expects.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	See, e.g., **802.11-2021** **3.1 Definitions** **downlink multi-user multiple input, multiple output (DL-MU-MIMO):** A technique by which an access point (AP) with more than one antenna transmits a physical layer (PHY) protocol data unit (PPDU) to multiple receiving non-AP stations (STAs) over the same radio frequencies, wherein each non-AP STA simultaneously receives one or more distinct space-time streams. **multi-user multiple input, multiple output (MU-MIMO):** A technique by which multiple stations (STAs), each with one or more antennas, either simultaneously transmit to a single STA or simultaneously receive from a single STA independent data streams over the same radio frequencies. NOTE—IEEE 802.11 supports only downlink (DL) MU-MIMO. See DL-MU-MIMO. **802.11ac** **22. Very High Throughput (VHT) PHY specification** **22.1 Introduction** **22.1.1 Introduction to the VHT PHY** Clause 22 specifies the PHY entity for a very high throughput (VHT) orthogonal frequency division multiplexing (OFDM) system. In addition to the requirements in Clause 22, a VHT STA shall be capable of transmitting and receiving PPDUs that are compliant with the mandatory PHY specifications defined in Clause 20.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	The VHT PHY is based on the HT PHY defined in Clause 20, which in turn is based on the OFDM PHY defined in Clause 18. The VHT PHY extends the maximum number of space-time streams supported to eight and provides support for downlink multi-user (MU) transmissions. A downlink MU transmission supports up to four users with up to four space-time streams per user with the total number of space-time streams not exceeding eight. . . . A VHT STA **may** support the following features: — HT-greenfield format (transmit and receive) — 2 or more spatial streams (transmit and receive) — 400 ns short guard interval (transmit and receive) — Beamforming sounding (by sending a VHT NDP) — Responding to transmit beamforming sounding (by providing compressed beamforming feedback) — STBC (transmit and receive) — LDPC (transmit and receive) — VHT MU PPDUs (transmit and receive)
[44D] transmitting signals, by a transmitting component in the terminal, on said communication channel.	[*See* claim element 1A with respect to how Wi-Fi 6 (and later) AT&T client devices satisfy this claim limitation.] **Wi-Fi 5 (and later) APs** Additionally, Wi-Fi 5 (and later) APs provided by AT&T include a transmitter (e.g., RF front end circuitry and related software) that transmits signals on the communication channel. 802.11ac sets forth transmitting component (*see, e.g.*, Figure 22-7 and Figure 22-12) in the terminal, on said communication channel. The below cited figures show the flow for turning a data frame's digital bits into modulation and, at the end of these flows, it shows these modulations are sent out via transmit chains in analog on the RF. Therefore, Wi-Fi 5 (and later) APs provided by AT&T transmit MU PPDU signals as analog signals onto the channel.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	802.11ac **22.3.2 VHT PPDU format** The VHT-SIG-A, VHT-STF, VHT-LTF, and VHT-SIG-B fields exist only in VHT PPDUs. **22.3.3 Transmitter block diagrams** The generation of each field in a VHT PPDU uses many of the following blocks . . . Figure 22-6 and Figure 22-7 show the transmit process for generating the VHT-SIG-B field of a VHT SU PPDU and VHT MU PPDU, respectively, in 20 MHz, 40 MHz, and 80 MHz channel widths. Figure 22-8 and Figure 22-9 show the transmit process for generating the VHT_SIG-B field of a 160 MHz and 80+80 MHz VHT SU PPDU, respectively. Figure 22-12 shows the transmit process for generating the Data field of a 20 MHz, 40 MHz, or 80 MHz VHT MU PPDU with BCC and LDPC encoding.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

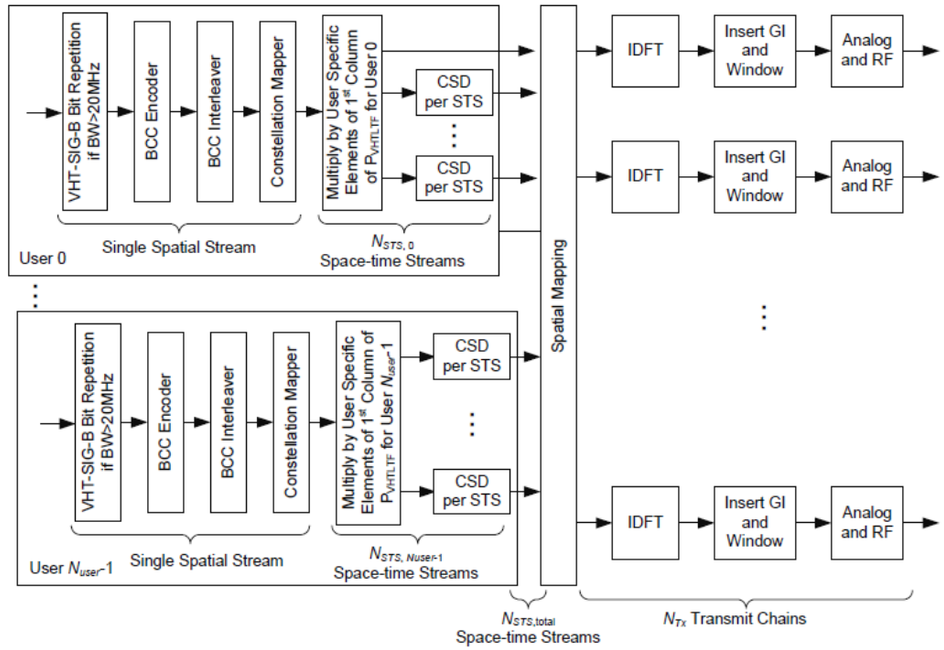


Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

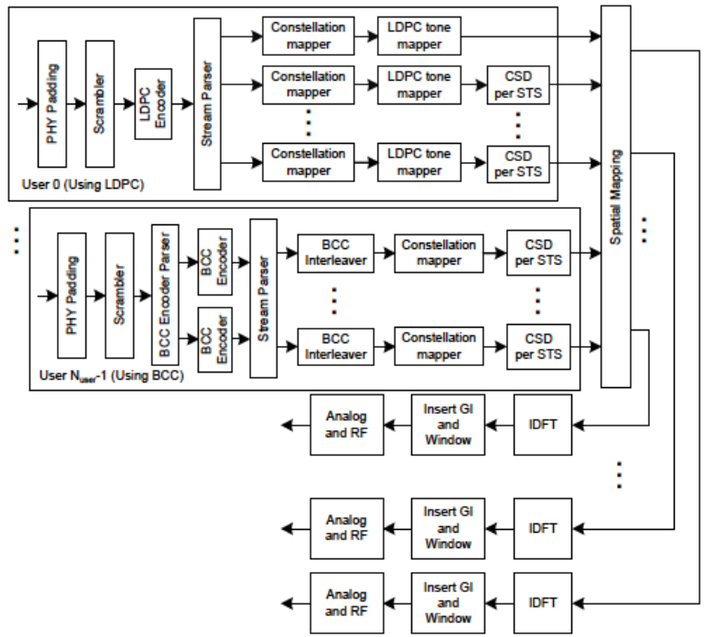


Figure 22-12—Transmitter block diagram for the Data field of a 20 MHz, 40 MHz, or 80 MHz VHT MU PPDU

22.3.4.10 Construction of the Data field in a VHT MU PPDU

22.3.4.10.1 General

For an MU transmission, the PPDU encoding process is performed on a per-user basis up to the input of the Spatial Mapping block except CSD (as described in 22.3.8.3.2). All user data is combined and mapped to the transmit chains in the Spatial Mapping block.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	22.3.4.10.4 Combining to form a VHT MU PPDU The per-user data is combined as follows: a) Spatial Mapping: The Q matrix is applied as described in 22.3.10.11.1. The combining of all user data is done in this block. b) Phase rotation: Apply the appropriate phase rotations for each 20 MHz subchannel as described in 22.3.7.4 and 22.3.7.5. c) IDFT: Compute the inverse discrete Fourier transform. d) Insert GI and apply windowing: Prepend a GI (SHORT_GI or LONG_GI) and apply windowing as described in 22.3.7.4. e) Analog and RF: Up-convert the resulting complex baseband waveform associated with each transmit chain to an RF signal according to the center frequency of the desired channel and transmit. Refer to 22.3.7.4 and 22.3.8 for details.
[51Pre] A data communication system comprising:	[*See* claim element 1Pre.]
[51A] a plurality of terminals connected to a communication channel, each terminal transmitting signals onto said communication channel, and receiving signals transmitted on said communication channel by other terminals, said receiving comprising separating and substantially decoding the signals	[*See* claim element 1A.]

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
sent simultaneously by multiple other terminals, each terminal comprising:	
[51B] a monitoring subsystem determining whether signal energy of transmissions on said communication channel exceeds a predetermined amount;	[*See* claim element 1B.]
[51C] a component generating and processing data packets; and	[*See* claim element 1C.]
[51D] a control subsystem that accepts said data packets from said component and determines a manner in which to successfully transmit said data packets over said communication channel simultaneously with other data packets transmitted by at least one other terminal and, if it has been determined that said signal energy exceeds said predetermined amount, does not allow the terminal to begin	[*See* claim element 26D.]

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
to transmit on said communication channel.	
[56 Pre] A terminal system comprising:	[*See* claim element 26Pre with respect to how Wi-Fi 6 (and later) AT&T client devices satisfy this claim limitation.] Additionally, AT&T provides Internet service with Wi-Fi including routers and access points (collectively, "access points", "access point stations (STAs)" or "APs") that that are "terminal systems" that transmitting data packets via downlink multi-user MIMO according to 802.11ac and later standards. The IEEE 802.11ac WLAN standard is collectively composed of the 802.11ac amendment (herein referred to as "Wi-Fi 5" or "802.11ac") to the 802.11 standard (herein referred to as "802.11-2021").
[56A] a monitoring subsystem determining whether signal energy of transmissions on a communication channel exceeds a predetermined amount, and said monitoring subsystem, if it has been determined that said signal energy exceeds a predetermined amount, does not allow the terminal to begin to transmit on said communication channel;	The Wi-Fi 6 (and later) client devices sold by AT&T are equipped with a monitoring system that determines whether the signal energy on the channel exceeds a predetermined threshold. The client devices implement the Uplink Multiuser Carrier Sense mechanism, which uses energy detection (ED)-based Clear Channel Assessment (CCA). Based on the ED, the device determines whether to transmit or refrain from transmitting data packets over the communication channel. According to 802.11ax, a non-AP STA is permitted to transmit an HE TB PPDU after a SIFS period following the reception of a PPDU, provided the following conditions are met: 1) The received PPDU contains a Trigger frame, 2) Either the CS Required subfield in the Trigger frame is set to 1 and the UL MU CS condition indicates that the medium is idle, or the CS Required subfield is set to 0. Additionally, as indicated by the evidence below, data packets are transmitted simultaneously from STAs to the AP. If the UL MU CS condition shows that the medium is busy (i.e., the communication channel exceeds a predetermined threshold), the control subsystem prevents the STA from starting its data transmission.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

26.5.2.5 UL MU CS mechanism

The ED-based CCA and virtual CS functions are used to determine the state of the medium if CS is required before responding to a received Trigger frame. ED-based CCA for the UL MU CS mechanism is defined in 27.3.20.6.4, and virtual CS is defined in 10.3.2.1.

26.5.2 UL MU operation

26.5.2.1 General

UL MU operation allows an AP to solicit simultaneous immediate response frames from one or more non-AP HE STAs. A non-AP HE STA shall follow the rules in this subclause for the transmission of response frames in an HE TB PPDU, unless the Trigger frame is an MU-RTS Trigger frame, in which case the response is a CTS frame sent in a non-HT PPDU (see 26.2.6).

If the CS Required subfield in a Trigger frame is 1, then the non-AP STA shall consider the status of the CCA [using energy detect defined in 27.3.20.6.2 and the virtual carrier sense (NAV)] during the SIFS between the Trigger frame and the PPDU sent in response to the Trigger frame. In this case, the non-AP STA shall sense the medium using energy detect after receiving the PPDU that contains the Trigger frame (i.e., during the SIFS), and it shall perform the energy detect at least in the subchannel that contains the non-AP STA's UL allocation, where the sensed subchannel consists of one or more 20 MHz channels. The non-AP STA may transmit the solicited PPDU if the 20 MHz channels containing the RUs allocated in the Trigger frame are considered idle. If the non-AP STA detects that the 20 MHz channels containing the allocated RUs are not all idle, then the non-AP STA shall not transmit.

NOTE 5—The solicited PPDU is a non-HT or non-HT duplicate PPDU if the Trigger frame is an MU-RTS Trigger frame (see 26.2.6); otherwise, the solicited PPDU is an HE TB PPDU (see 26.5.2.3).

The CS Required subfield in the MU-RTS Trigger frame shall be set to 1.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	An AP that transmits a Basic, BSRP, MU-BAR, BQRP, or GCR MU-BAR Trigger frame shall set the CS Required subfield to 1, unless one of the following conditions is met: — The RA of the Trigger frame is an individually addressed non-AP STA's MAC address, a QoS Data frame with HETP Ack ack policy and/or a Management frame that solicits an acknowledgment is aggregated with the Trigger frame in an A-MPDU, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418. — The Trigger frame is either an MU-BAR or a GCR MU-BAR Trigger frame, and the UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 418. — The UL Length subfield in the Common Info field of the Trigger frame is less than or equal to 76. **Source:** IEEE 802.11 ax, Page 341, and 357 of 766. **27.3.20.6 CCA sensitivity** **27.3.20.6.1 General** The thresholds in 27.3.20.6 are compared with the signal level at each receiving antenna. **27.3.20.6.2 CCA sensitivity for operating classes requiring CCA-ED** For the operating classes requiring CCA-Energy Detect (CCA-ED), the PHY shall indicate a medium busy condition if CCA-ED detects a channel busy condition. For improved spectrum sharing, CCA-ED is required in some bands. The behavior class indicating CCA-ED is given in Table D-2. The operating classes

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	requiring the corresponding CCA-ED behavior class are given in E.1. The PHY of a STA that is operating within an operating class that requires CCA-ED shall operate with CCA-ED. CCA-ED for a STA that is attempting a non-preamble puncturing transmission shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for the primary 20 MHz channel, dot11OFDMEDThreshold for the secondary 20 MHz channel (if present), dot11OFDMEDThreshold + 3 dB for the secondary 40 MHz channel (if present), and dot11OFDMEDThreshold + 6 dB for the secondary 80 MHz channel (if present). The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5. CCA-ED for a STA that is attempting a preamble puncturing transmission shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for the primary 20 MHz channel and dot11OFDMEDThreshold for each nonprimary 20 MHz subchannel. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5. For the HE TB PPDU transmission, for each of 20 MHz sub-channels that require CCA, CCA-ED shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold. The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5. For transmissions that carry a frame that includes a BQR Control subfield (see 9.2.4.6a), CCA-ED shall detect a channel busy condition if the received signal strength exceeds the CCA-ED threshold as given by dot11OFDMEDThreshold for primary 20 MHz channel and dot11OFDMEDThreshold for each nonprimary 20 MHz channel (if present). The CCA-ED thresholds for the operating classes requiring CCA-ED are subject to the criteria in D.2.5. NOTE—The requirement to detect a channel busy condition as stated in 27.3.20.6.3 and 27.3.20.6.4 is a mandatory energy detect requirement on all Clause 27 receivers. Support for CCA-ED is an additional requirement that relates specifically to the sensitivities described in D.2.5. **Source:** IEEE 802.11 ax, Page 644 and 645 of 766.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

27. High-efficiency (HE) PHY specification

27.1 Introduction

27.1.1 Introduction to the HE PHY

Clause 27 specifies the PHY entity for a high-efficiency (HE) orthogonal frequency division multiplexing (OFDM) system. In addition to the requirements in Clause 27, an HE STA shall be capable of transmitting and receiving PPDUs that are compliant with the mandatory requirements of the following PHY specifications:

- Clause 19 and Clause 21 if the HE STA supports an operating channel width greater than or equal to 80 MHz and is operating in the 5 GHz band.
- Clause 19 and Clause 21 transmission and reception on 20 MHz channel width (see 26.17.1) if the HE STA is a 20 MHz-only non-AP HE STA and is operating in the 5 GHz band.
- Clause 19 if the HE STA is operating in the 2.4 GHz band.
- Clause 17 if the HE STA is operating in the 6 GHz band.

For 2.4 GHz band operation, the HE PHY is based on HT PHY defined in Clause 19, which in turn is based on the OFDM PHY defined in Clause 17.

For 5 GHz band operation, the HE PHY is based on the VHT PHY defined in Clause 21, which in turn is based on the HT PHY defined in Clause 19, which in turn is further based on the OFDM PHY defined in Clause 17.

For 6 GHz band operation, the HE PHY is based on the OFDM PHY defined in Clause 17.

According to 802.11ax, all HE STAs (terminals supporting Wi-Fi 6) must comply with Clause 27. Clause 27 requires that all HE STAs implement the Multiuser Carrier Sense mechanism, which defines an energy detection

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	(ED)-based Clear Channel Assessment (CCA) technique. This clause refers to the HE PHY specification, which is followed by all Wi-Fi 6 compliant devices, including smartphones like the iPhone 16 that support Wi-Fi 6. [*The 802.11ax standard addresses CCA (Clear Channel Assessment) sensitivity for operating classes that require CCA with energy detection (CCA-ED). All accused Wi-Fi 6 devices, e.g., smartphones, tablets and access points, are designed to comply with these requirements. Wi-Fi 6 devices adhere to the specified sensitivity thresholds and regulatory constraints, ensuring proper CCA-ED functionality across different operating conditions, bands, and channels.*] **27.2.6 Support for non-HT, HT, and VHT formats** **27.2.6.1 General** An HE STA logically contains Clause 15, Clause 16, Clause 17, Clause 18, Clause 19, Clause 21, and Clause 27 PHYs. The MAC interacts with the PHYs via the Clause 27 PHY service interface, which in turn interacts with the Clause 15, Clause 16, Clause 17, Clause 18, and Clause 19, and Clause 21 PHY service interfaces as shown in Figure 27-1, Figure 27-2, and Figure 27-3.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

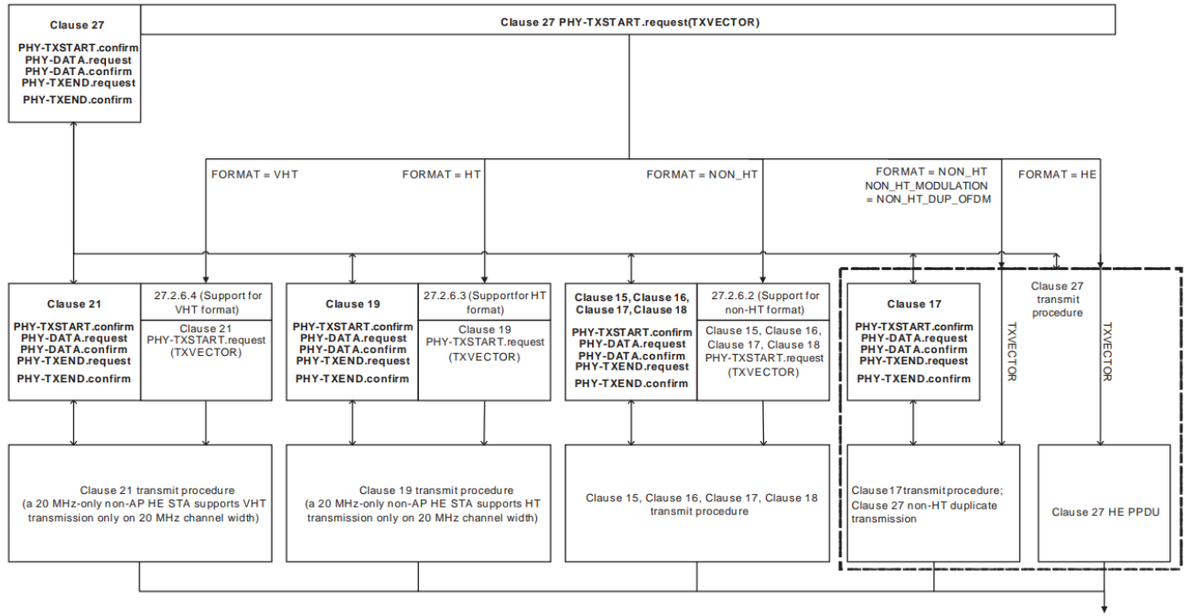


Figure 27-1—PHY interaction on transmit for various PPDU formats

Source: IEEE 802.11 ax, Page 493 of 766.

According to 802.11ax, an AP sends a trigger frame to the STAs, and if the CS required subfield in the trigger frame is set to 1, the STA must check the status of the CCA. The STA senses the CCA Energy Detect (CCA-ED) and compares it to the CCA-ED threshold.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

27.3.20.6.3 CCA sensitivity for the primary 20 MHz channel

An HE STA with a *W* MHz operating channel width shall detect, with > 90% probability, the start of a PPDU that occupies at least the primary 20 MHz channel in an otherwise idle *W* MHz channel width and issue a PHY-CCA.indication with the STATUS parameter set to BUSY within a period of aCCATime (see 21.4.4) if one of the following conditions is met:

— The start of a non-HT PPDU as defined in 17.3.10.6 if operating in the 5 GHz or 6 GHz band and 18.4.6 if operating in the 2.4 GHz band.

— The start of an HT PPDU as defined in 19.3.19.5.

— The start of a non-HT duplicate, VHT or HE PPDU for which the power measured within the primary 20 MHz channel is at or above –82 dBm.

The channel-list parameter is present and set to {primary} if the operating channel width is greater than 20 MHz. The CCA signal shall be held busy (not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE) for the duration of the PPDU, unless it receives a CCARESET.request primitive before the end of the PPDU, for instance, during spatial reuse operation as described in 26.10.

The receiver shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY for any signal that exceeds a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (–82 + 20 = –62 dBm) in the primary 20 MHz channel within a period of aCCATime after the signal arrives at the receiver's antenna(s). If the operating channel width is greater than 20 MHz, then the channel-list parameter is present and shall be set to {primary}. Following the indication and while the threshold continues to be exceeded, the receiver shall not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE or with a change in the channel-list parameter.

Source: IEEE 802.11 ax, Page 645 and 646 of 766

Wi-Fi 5 (and later) APs

Additionally, Wi-Fi 5 (and later) APs provided by AT&T include a monitoring subsystem (e.g., hardware and associated software implementing portions of the Wi-Fi 5 physical layer that monitor signal energy on a communication channel) that senses a communication channel (e.g., determining the "state of the medium" using

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	the CCA function in the PHY layer) to determine whether signal energy on said communication channel exceeds a predetermined amount. (See limitation [44A].). If it has been determined that said signal energy exceeds said predetermined amount, the control subsystem prevents the terminal from transmitting on said communication channel. (See limitation [44B].)
[56B] component generating and processing network data packets; and	[See claim element 1C with respect to how Wi-Fi 6 (and later) AT&T client devices satisfy this claim limitation.] **Wi-Fi 5 (and later) APs** Additionally, Wi-Fi 5 (and later) APs provided by AT&T include a component generating and processing network data backets (e.g., hardware and associated software implementing portions of the Wi-Fi 5 MAC layer). Generating and processing network data packet are fundamental to 802.11 and 802.11ac. The cites below explain how in MU-MIMO, as implemented by 802.11ac, one type of network data packet (e.g., VHT MU PPDU) is generated and processed. 802.11 clarifies that in the MAC layer, MSDU(s) are encapsulated and may be aggregated into an A-MPDU by the MAC data service architecture. Thus, during a transmission, the frame that leaves the MAC layer and enters the PHY layer can be an A-MPDU (which contains one or more MSDUs). 802.11ac further states that an A-MPDU obtained from the MAC data service architecture is transmitted at the PHY in a PSDU frame. In an 802.11ac PHY layer, the PSDU is encapsulated in a PPDU for transmission by the PHY. This confirms that PSDUs are contained in PPDUs that are to be transmitted by the PHY. Furthermore, PPDUs in accordance with the ac Amendment can include MU PPDUs.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	802.11-2021 **5. MAC service definition** **5.1 Overview of MAC services** **5.1.1 Data service** **5.1.1.1 General** This service provides peer LLC entities with the ability to exchange MSDUs. To support this service, the local MAC uses the underlying PHY-level services to transport an MSDU to a peer MAC entity, where it is delivered to the peer LLC. … **5.1.5 MAC data service architecture** **5.1.5.1 General** The MAC data plane architecture (i.e., processes that involve transport of all or part of an MSDU) is shown in Figure 5-1. … During transmission, an MSDU goes through the processes shown in the left-hand side of Figure 5-1. When transparent FST is used, an MSDU first goes, as shown in Figure 5-2, through an additional transparent FST entity that contains a demultiplexing process that forwards the MSDU down to the selected TX MSDU Rate Limiting process and from there to MAC data plane processing as described in the previous sentence. IEEE Std 802.1X-2010 may block the MSDU at the Controlled Port before the preceding processing occurs. Otherwise, at some point, the Data frames that contain all or part of the MSDU are queued per AC/TS.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

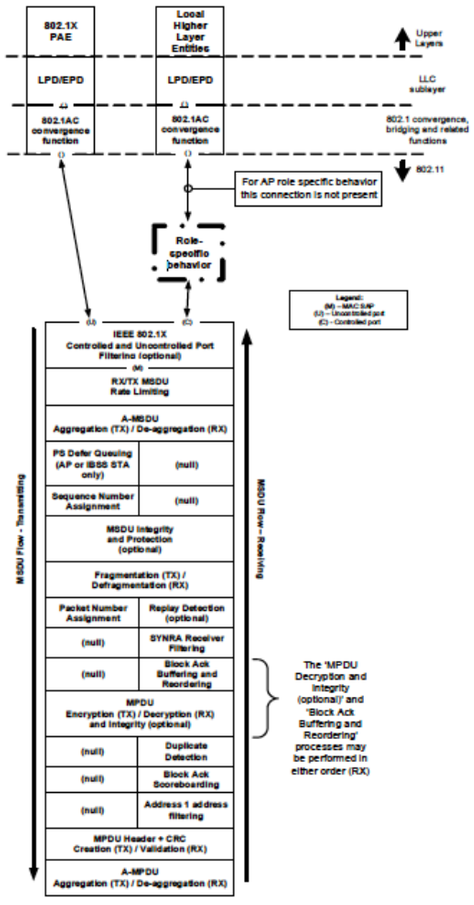


Figure 5-1—MAC data plane architecture

10.12.5 Transport of A-MPDU by the PHY data service

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	An A-MPDU shall be transmitted in a PSDU associated with a PHY-TXSTART.request primitive with the TXVECTOR parameter AGGREGATION set to 1 or the TXVECTOR parameter FORMAT set to VHT. A received PSDU is determined to be an A-MPDU when the associated PHY-RXSTART.indication primitive RXVECTOR parameter AGGREGATION is equal to 1 or the RXVECTOR parameter FORMAT is equal to VHT. **3.1 Definitions** **beamformee:** A station (STA) that receives a physical layer convergence procedure (PLCP) protocol data unit (PPDU) that was transmitted using a beamforming steering matrix. **beamformer:** A station (STA) that transmits a physical layer convergence procedure (PLCP) protocol data unit (PPDU) using a beamforming steering matrix. **802.11ac** **22.1.2 Scope** The services provided to the MAC by the VHT PHY consist of the following protocol functions: a) A function that defines a method of mapping the PSDUs into a framing format (PPDU) suitable for sending and receiving PSDUs between two or more STAs. b) A function that defines the characteristics and method of transmitting and receiving data through a wireless medium between two or more STAs. Depending on the PPDU format, these STAs support a mixture of VHT: Clause 20 and Clause 18 PHYs. **22.1.3 VHT PHY functions** **22.1.3.1 General**

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	The VHT PHY contains two functional entities: the PHY function and the physical layer management function (i.e., the PLME). Both of these functions are described in detail in 22.3 and 22.4. **22.3 VHT PHY layer** **22.3.1 Introduction** This subclause provides the procedure by which PSDUs are converted to and from transmissions on the wireless medium. During transmission, a PSDU (in the SU case) or one or more PSDUs (in the MU case) are processed (i.e., scrambled and coded) and appended to the PHY preamble to create the PPDU. At the receiver, the PHY preamble is processed to aid in the detection, demodulation, and delivery of the PSDU. **22.1.4 PPDU formats** The structure of the PPDU transmitted by a VHT STA is determined by the TXVECTOR parameters as defined in Table 22-1. For a VHT STA, the FORMAT parameter determines the overall structure of the PPDU and includes the following: — Non-HT format (NON_HT), based on Clause 18 and including non-HT duplicate format. — HT-mixed format (HT_MF) as specified in Clause 20. — HT-greenfield format (HT_GF) as specified in Clause 20. — VHT format (VHT). PPDUs of this format contain a preamble compatible with Clause 18 and Clause 20 STAs. The non-VHT portion of the VHT format preamble (the parts of VHT preamble preceding the VHT-SIG-A field) is defined so that it can be decoded by these STAs. NOTE—Required support for these formats is defined in 10.39, 20.1.1, and 22.1.1.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	A VHT PPDU can be further categorized as a VHT SU PPDU or a VHT MU PPDU. A VHT PPDU using a group ID value of 0 or 63 is a VHT SU PPDU and either carries only one PSDU or no PSDU. A VHT PPDU using a group ID value in the range of 1 to 62 is a VHT MU PPDU and carries one or more PSDUs to one or more users.
[56C] a control subsystem that accepts said network data packets from said component and determines a manner in which to transmit said network data packets over said communication channel simultaneously to a plurality of receiving systems;	[See claim elements 1D and 1E with respect to how Wi-Fi 6 (and later) AT&T client devices satisfy this claim limitation.] **Wi-Fi 5 (and later) APs** Additionally, Wi-Fi 5 (and later) APs provided by AT&T include a control subsystem (e.g., a processor and associated software for implementing portions of the Wi-Fi 6 PHY layer functionality on the device that determines a manner in which to transmit packets over the communications channel) that accepts said network data packets from said component and determines a manner in which to transmit said network data packets over said communication channel simultaneously to a plurality of receiving systems. For example, 802.11ac describes a control subsystem (e.g., the PHY layer that handles VHT) that accepts the network data packets from the component and determines a manner in which to transmit said network data packets over said communication channel simultaneously to a plurality of receiving systems by providing a description of how to steer signals to send VHT MU PPDUs with DL-MU-MIMO beamforming techniques. Subclauses 22.3.11.1 to .3 of the ac Amendment describe mechanics for how the transmitter "is to steer signals using knowledge of the channel." *See, e.g.*, **22.1.4 PPDU formats** …

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	A VHT PPDU can be further categorized as a VHT SU PPDU or a VHT MU PPDU. **22.3.11 SU-MIMO and DL-MU-MIMO Beamforming** **22.3.11.1 General** SU-MIMO and DL-MU-MIMO beamforming are techniques used by a STA with multiple antennas (the beamformer) to steer signals using knowledge of the channel to improve throughput. With SU-MIMO beamforming all space-time streams in the transmitted signal are intended for reception at a single STA. With DL-MU-MIMO beamforming, disjoint subsets of the space-time streams are intended for reception at different STAs. … The DL-MU-MIMO steering matrix can be determined by the Qk … can be determined by the beamformer using the beamforming feedback matrices for subcarrier *k* from beamformee *u*, *Vk,u,* and SNR information for subcarrier *k* from beamformee *u*, *SNRk,u*, where . The steering matrix that is computed (or updated) using new beamforming feedback matrices and new SNR information from some or all of participating beamformees might replace the existing steering matrix for the next DL-MUMIMO data transmission. The beamformee group for the MU transmission is signaled using the Group ID field in VHT-SIG-A (see 22.3.8.3.3 and 22.3.11.4). **22.5 Parameters for VHT-MCSs** The rate-dependent parameters for 20 MHz, 40 MHz, 80 MHz, 160 MHz, and 80+80 MHz are given in Table 22-30 through Table 22-61 . . . Table 22-30 to Table 22-33, Table 22-38 to Table 22-41, Table 22-46 to Table 22-49, and Table 22-54 to Table 22-57 define VHT-MCSs not only for SU transmission but also for user *u* of MU transmission. In the case of VHT-

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	MCSs for MU transmission, the parameters, *NSS*, *R*, *NBPSCS*, *NCBPS*, *NDBPS*, and *NES* are replaced with *NSS,u*, *Ru*, *NBPSCS,u*, *NCBPS,u*, *NDBPS,u*, and *NES,u*, respectively.
[56D] multiple ones of said network data packets transmitted simultaneously over said communication channel being separated and substantially decoded at each receiver from said plurality of receiving systems.	[See claim element 1A.] **Wi-Fi 5 (and later) APs** Additionally, Wi-Fi 5 (and later) APs provided by AT&T include a transmitter (e.g., RF front end circuitry and related software) that transmits multiple ones of the network data packets simultaneously over the communications channel, which are separated and substantially decoded at each receiver from the plurality of receiving systems. 802.11ac describes that multiple ones of said network data packets are transmitted by a transmitting component (e.g., Figures 22-7 and 22-12). The figure shows the flow for turning a data frame's digital bits into modulation and, at the end of these flows, it shows these modulations are sent out via transmit chains in analog on the RF. With DL-MU-MIMO, a transmitting STA can send to multiple receiving STAs simultaneously, and a receiving STA can receive from multiple transmitting STAs simultaneously. To allow this to occur "successfully", Wi-Fi 5 (and later) APs use a VHT MU PPDU, and the sending and receiving STAs are configured to send/receive (respectively) RF signals that are appropriately formed to transmit in a manner that both expect. *See, e.g.*,

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

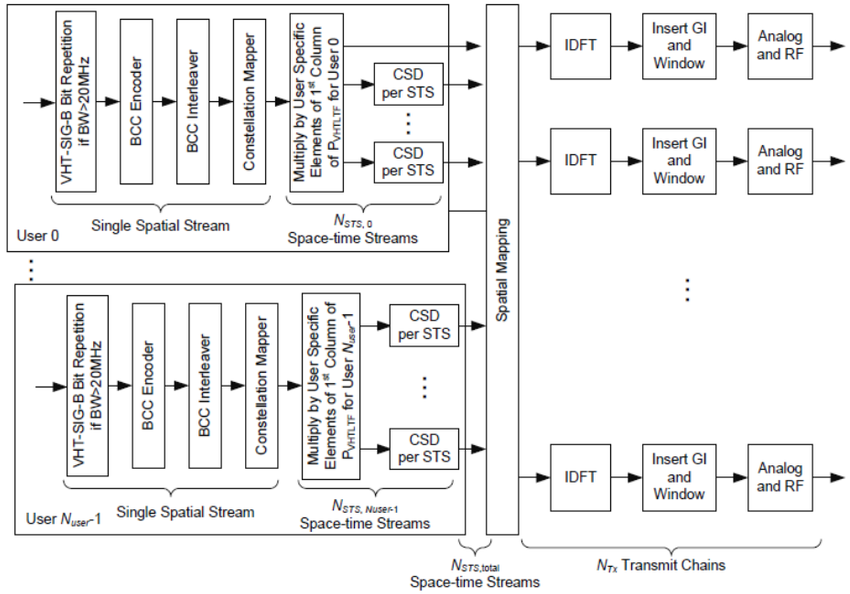

Figure 22-7—Transmitter block diagram for the VHT-SIG-B field of a 20 MHz, 40 MHz, and 80 MHz VHT MU PPDU

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)

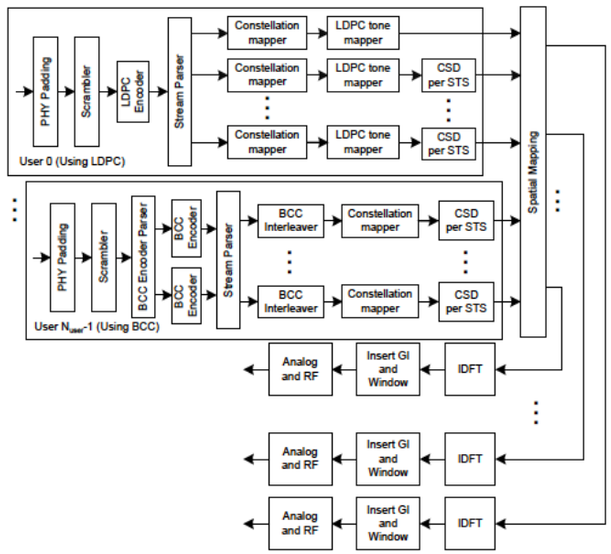

Figure 22-12—Transmitter block diagram for the Data field of a 20 MHz, 40 MHz, or 80 MHz VHT MU PPDU

22.3.4.10 Construction of the Data field in a VHT MU PPDU

22.3.4.10.1 General

For an MU transmission, the PPDU encoding process is performed on a per-user basis up to the input of the Spatial Mapping block except CSD (as described in 22.3.8.3.2). All user data is combined and mapped to the transmit chains in the Spatial Mapping block.

22.3.4.10.4 Combining to form a VHT MU PPDU

The per-user data is combined as follows:

a) Spatial Mapping: The Q matrix is applied as described in 22.3.10.11.1. The combining of all user data is done in this block.

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	b) Phase rotation: Apply the appropriate phase rotations for each 20 MHz subchannel as described in 22.3.7.4 and 22.3.7.5. c) IDFT: Compute the inverse discrete Fourier transform. d) Insert GI and apply windowing: Prepend a GI (SHORT_GI or LONG_GI) and apply windowing as described in 22.3.7.4. e) Analog and RF: Up-convert the resulting complex baseband waveform associated with each transmit chain to an RF signal according to the center frequency of the desired channel and transmit. Refer to 22.3.7.4 and 22.3.8 for details. **802.11-2021** **3.1 Definitions** **downlink multi-user multiple input, multiple output (DL-MU-MIMO):** A technique by which an access point (AP) with more than one antenna transmits a physical layer (PHY) protocol data unit (PPDU) to multiple receiving non-AP stations (STAs) over the same radio frequencies, wherein each non-AP STA simultaneously receives one or more distinct space-time streams. **multi-user multiple input, multiple output (MU-MIMO):** A technique by which multiple stations (STAs), each with one or more antennas, either simultaneously transmit to a single STA or simultaneously receive from a single STA independent data streams over the same radio frequencies. NOTE—IEEE 802.11 supports only downlink (DL) MU-MIMO. See DL-MU-MIMO. **802.11.ac** **22. Very High Throughput (VHT) PHY specification** **22.1 Introduction** **22.1.1 Introduction to the VHT PHY**

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	Clause 22 specifies the PHY entity for a very high throughput (VHT) orthogonal frequency division multiplexing (OFDM) system. In addition to the requirements in Clause 22, a VHT STA shall be capable of transmitting and receiving PPDUs that are compliant with the mandatory PHY specifications defined in Clause 20. The VHT PHY is based on the HT PHY defined in Clause 20, which in turn is based on the OFDM PHY defined in Clause 18. The VHT PHY extends the maximum number of space-time streams supported to eight and provides support for downlink multi-user (MU) transmissions. A downlink MU transmission supports up to four users with up to four space-time streams per user with the total number of space-time streams not exceeding eight. . . . A VHT STA **may** support the following features: — HT-greenfield format (transmit and receive) — 2 or more spatial streams (transmit and receive) — 400 ns short guard interval (transmit and receive) — Beamforming sounding (by sending a VHT NDP) — Responding to transmit beamforming sounding (by providing compressed beamforming feedback) — STBC (transmit and receive) — LDPC (transmit and receive) — VHT MU PPDUs (transmit and receive) **22.1.4 PPDU formats** The structure of the PPDU transmitted by a VHT STA is determined by the TXVECTOR parameters as defined in Table 22-1. . . .

Claim	Accused Internet with Wi-Fi Service and related Products (AT&T Wi-Fi 5 (and higher) APs, Wi-F 6 (and higher) Client Devices)
	A VHT PPDU can be further categorized as a VHT SU PPDU or a VHT MU PPDU. A VHT PPDU using a group ID value of 0 or 63 is a VHT SU PPDU and either carries only one PSDU or no PSDU. A VHT PPDU using a group ID value in the range of 1 to 62 is a VHT MU PPDU and carries one or more PSDUs to one or more users. *The following citation is repeated for emphasis from the prior element:* **22.3.11 SU-MIMO and DL-MU-MIMO Beamforming** **22.3.11.1 General** SU-MIMO and DL-MU-MIMO beamforming are techniques used by a STA with multiple antennas (the beamformer) to steer signals using knowledge of the channel to improve throughput. With SU-MIMO beamforming all space-time streams in the transmitted signal are intended for reception at a single STA. With DL-MU-MIMO beamforming, disjoint subsets of the space-time streams are intended for reception at different STAs.